The Electrical Industry's Weekly Magazine

March 18, 1957

Electrical World

Price 35 Cents

A McGraw-Hill Publication

Turning Industrial Customers into Lighting Salesmen

...page 70

NRECA Meeting Report...page 58

E B POWER GS W 1
UNIVERSITY MICROFILMS I
313 N 1 ST
ANN ARBOR MICH

Compare cost of Regulators and LTC Transformers

Regulators save $4,167

Here's the money-saving way to regulate taking full advantage of *Vari-Amp* on Allis-Chalmers regulators.

1.
Select substation size: In example shown, we used: 3750 kva, 13.2 kv, 164 amps, self-cooled.

2.
Determine percent regulation required. Here's the important step. A careful check will disclose that few systems actually require full ±10% regulation today. In this example +8¾% −7½% is needed.

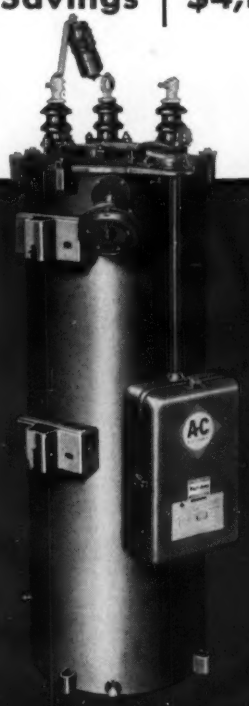
3.
Select proper size regulating unit based on current or kva and range of regulation.
To do this job, set up the no load taps on the transformer (or order an alternate voltage) for a 2½% voltage raise. It is then necessary to get only +6¼% raise from the regulator to obtain the desired 8¾% total raise.

On the buck side, −10% regulation from the regulator will provide the needed −7½% regulation for the system. The +2½% in the transformer algebraically added to −10% provides the −7½% buck.

Since an Allis-Chalmers regulator with *Vari-Amp* providing +6½% −10% regulation costs less than a ±10% unit of any type, you save $4167.00.

Here's a typical cost comparison on a 4330-volt feeder:	
Load tap changing portion of transformer	$9,471
3 single-phase Allis-Chalmers distribution regulators using *Vari-Amp*	$5,304
Savings	**$4,167**

Get the Key to Low Cost Regulation (No. A-5307) with complete charts and explanation of how to figure savings with *Vari-Amp*. Call your nearby A-C office, or write to Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



A-C ALLIS-CHALMERS

A-5332

Electrical World

Vol. 147, No. 11 MARCH 18, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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Co-ops Step Up Public Relations Efforts

More than 5,000 delegates at NRECA annual meeting at Chicago endorse action of association to boost publicity..p 58

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Artificial storage basin will be pumped full at night to provide power for Hamburg area during daytime peaks...p 68

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Turning Lighting Customers into Salesmen

By educating engineers employed by local industries, N. Y. State E&G finds that they sell themselves .....p 70

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New Refrigerant System Cuts A-C Demand

Modifications to conform to NEC circuit restrictions also provides improved cooling characteristics of unit.....p 78

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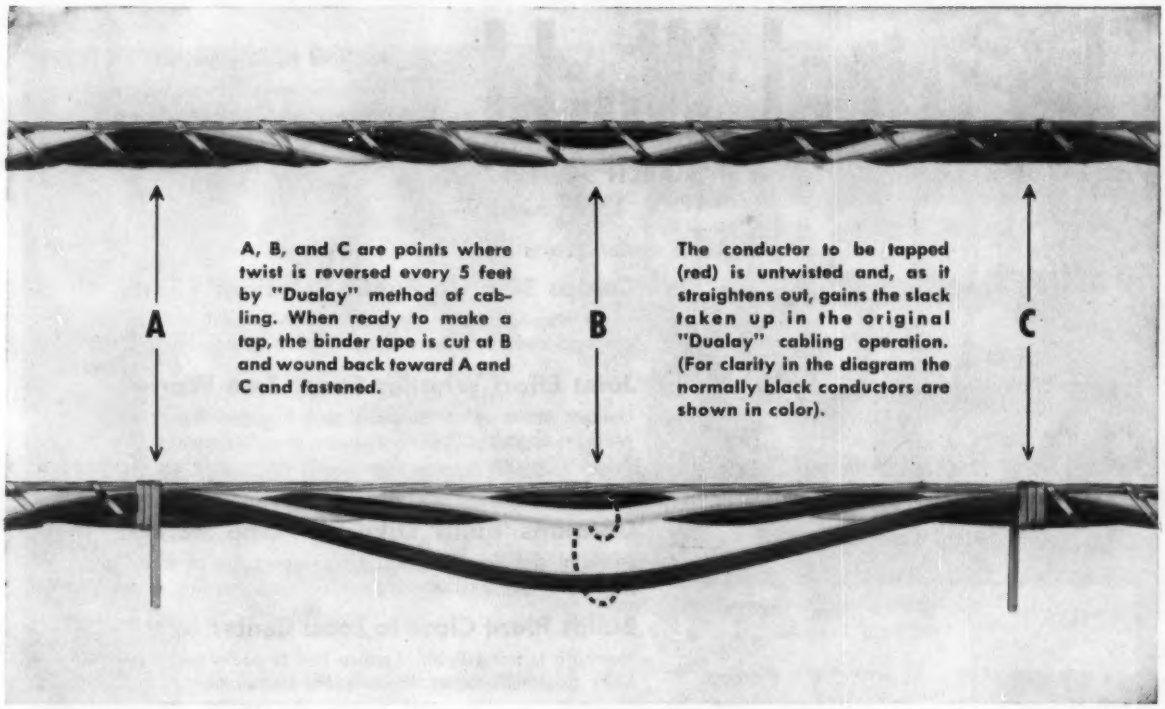
A
B
C
A, B, and C are points where twist is reversed every 5 feet by "Dualay" method of cabling. When ready to make a tap, the binder tape is cut at B and wound back toward A and C and fastened.
The conductor to be tapped (red) is untwisted and, as it straightens out, gains the slack taken up in the original "Dualay" cabling operation. (For clarity in the diagram the normally black conductors are shown in color).

how DUALAY* further reduces cost of self-supporting aerial cable

Most public utilities are fully aware of the economies of self-supporting aerial cable distribution systems. Savings are realized through ease of installation, reduction in tree trimming, fewer service interruptions, use of longer spans, and lower maintenance costs.

However, the DUALAY* assembly, originally developed by Okonite engineers and now a standard construction on all 3/c Okonite self-supporting cables up to 15kv, offers still further installation and maintenance economies.

Main feature of the Dualay assembly is that the direction of lay of conductors is reversed at regular short intervals. This permits unshielded cables to be tapped hot. (See diagram above.) The phases can be separated without cutting the copper or aluminum conductors and without performing any operation on the messenger. Design permits use of wire guards and rubber blankets for safety, and linemen can open up cable for tapping at a pole without use of a platform. Dualay assembly also prevents longitudinal or tension stress on the conductors and assures strain-free conductor splices.

Dualay assembly is available with either Okolite-Okoprene construction (strip-insulated type) or Keystone-Okoprene (extruded type). Bulletins are available on each. The Okonite Company, Passaic, N. J.

4347-A

available with either copper or aluminum conductors

***where there's electrical power . . . there's* OKONITE CABLE**

*U. S. Pat. No. 2,430,378

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. . . *from the publisher*

The moment news came of the Hiroshima and Nagasaki bombings back in 1945, Electrical World editors knew they would soon be on the biggest thing to happen to the industry since Pearl Street Station.

In the elapsed 12 years they've traveled thousands upon thousands of miles, researched countless volumes and papers, hammered out sheaves of copy, even pitched tents in the desert—all to keep our readers posted on atomic power's progress.

Today, atomic power plants are coming off the drawing board with increasing regularity. More and more sources of atomic information are being developed. To give utility powermen quickly and easily that which affects them most, the new Electrical World has come up with an "Atomic Progress" page—a concentrated package of the week's happenings in nuclear power (page 61).

Compiled jointly by Engineer Jack Kearney and the EW news staff, "Atomic Progress" is offered as a reader bonus over and above our regular schedule of technical nuclear articles. At the moment there are at least a half-dozen stories of the heavier variety being readied for print. And Kearney and his associates are rolling up their sleeves for still a bigger job: EW's second annual Nuclear Power Developments issue coming May 20.

Fischer Black

ELECTRICAL WORLD

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NOW!...*Finally!*...Here's a method all wrapped up in

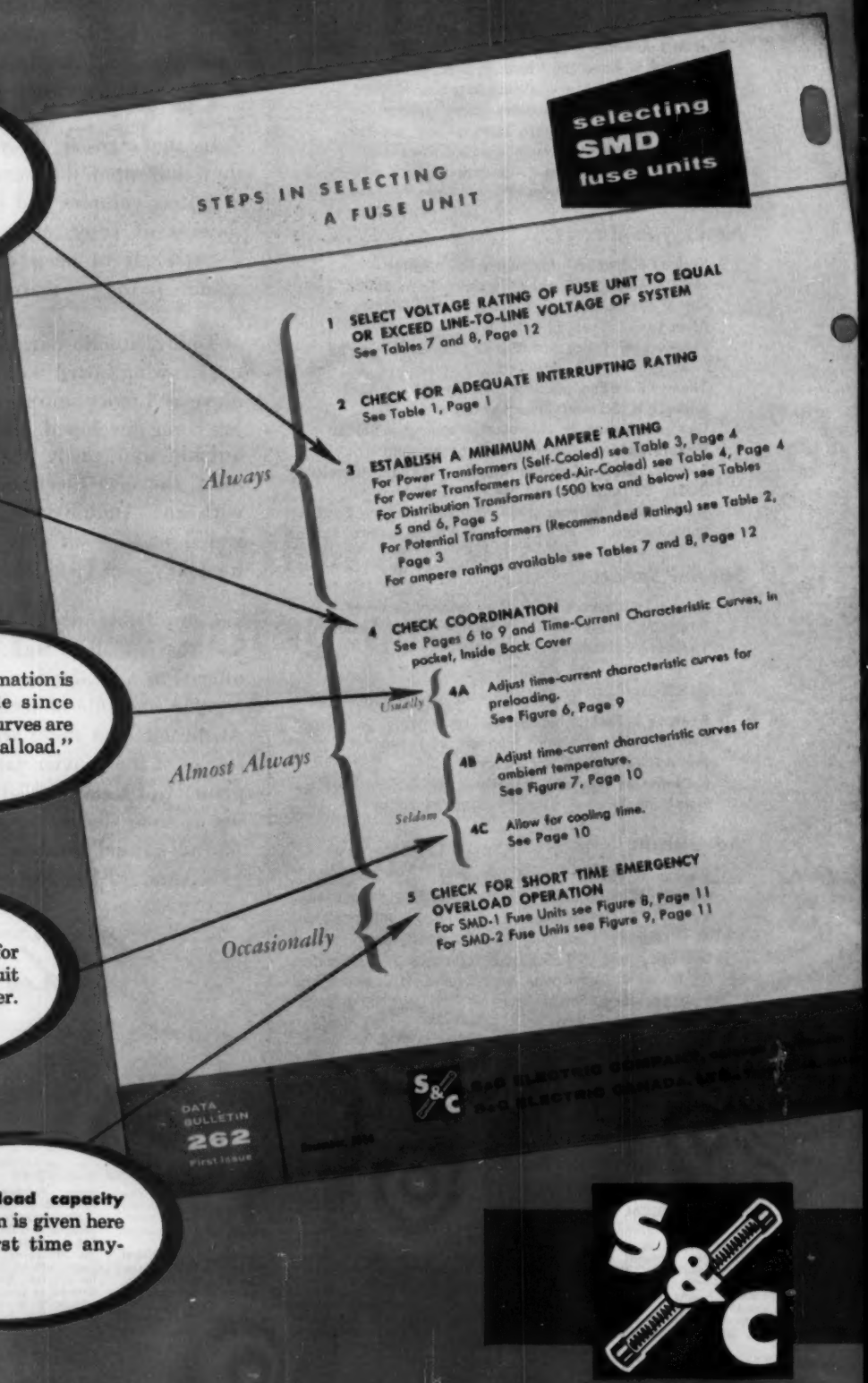
New ampere rating recommendations give maximum protection for transformers with precise allowances for short-time daily overloads.

Two methods of coordination are offered: Rule-of-thumb and Precision.

Preloading information is made available since Time-Current Curves are based on "no initial load."

How to compensate for successive short-circuit operations of the breaker.

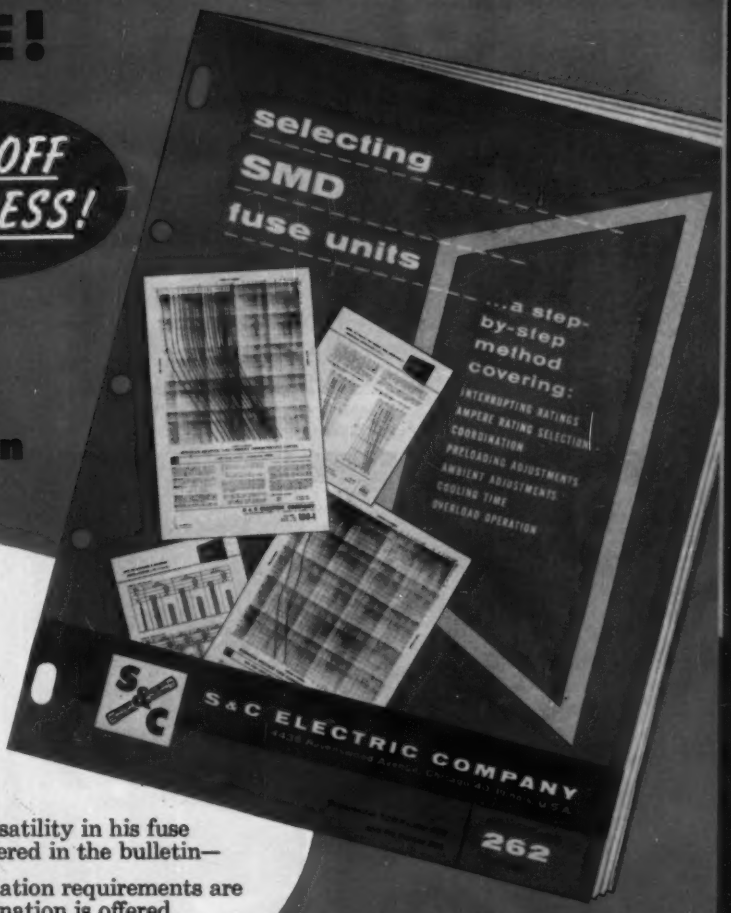
Fuse overload capacity information is given here for the first time anywhere.


selecting SMD fuse units
STEPS IN SELECTING A FUSE UNIT
1 SELECT VOLTAGE RATING OF FUSE UNIT TO EQUAL OR EXCEED LINE-TO-LINE VOLTAGE OF SYSTEM
See Tables 7 and 8, Page 12
2 CHECK FOR ADEQUATE INTERRUPTING RATING
See Table 1, Page 1
Always
3 ESTABLISH A MINIMUM AMPERE RATING
For Power Transformers (Self-Cooled) see Table 3, Page 4
For Power Transformers (Forced-Air-Cooled) see Table 4, Page 4
For Distribution Transformers (500 kva and below) see Tables 5 and 6, Page 5
For Potential Transformers (Recommended Ratings) see Table 2, Page 3
For ampere ratings available see Tables 7 and 8, Page 12
4 CHECK COORDINATION
See Pages 6 to 9 and Time-Current Characteristic Curves, in pocket, Inside Back Cover
Almost Always
Usually
4A Adjust time-current characteristic curves for preloading.
See Figure 6, Page 9
Seldom
4B Adjust time-current characteristic curves for ambient temperature.
See Figure 7, Page 10
4C Allow for cooling time.
See Page 10
Occasionally
5 CHECK FOR SHORT TIME EMERGENCY OVERLOAD OPERATION
For SMD-1 Fuse Units see Figure 8, Page 11
For SMD-2 Fuse Units see Figure 9, Page 11
DATA BULLETIN 262 First Issue
S&C

for power fuse coordination
ONE PACKAGE!

JUST OFF THE PRESS!

it frees you from hocus-pocus; it gives you more fuse protection



The key to this method is a step-by-step sequence as shown at the left (the first inside page of the new Data Bulletin 262).

For each step, all the necessary data is at your finger tips. You have a choice of two methods—

for the man who wants more range and versatility in his fuse coordination, a "precision" technique is offered in the bulletin—

for the man-on-the-go, whose fuse coordination requirements are not so rigorous, the "rule-of-thumb" coordination is offered.

Write today for your copy of this 12-page-plus-cover Data Bulletin 262, with necessary TCC curves.

S & C Power Fuse Type SMD, illustrated below: vertical style 69 kv.

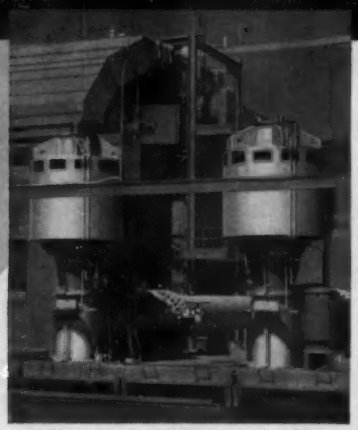
Specialists in High-Voltage Circuit Interruption Since 1910

S&C ELECTRIC COMPANY

In Canada: S & C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

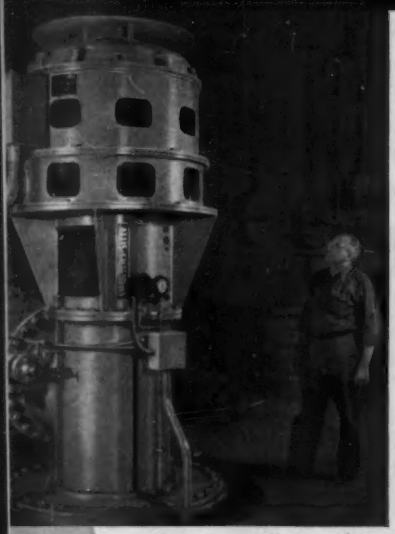
POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

condensing equipment...

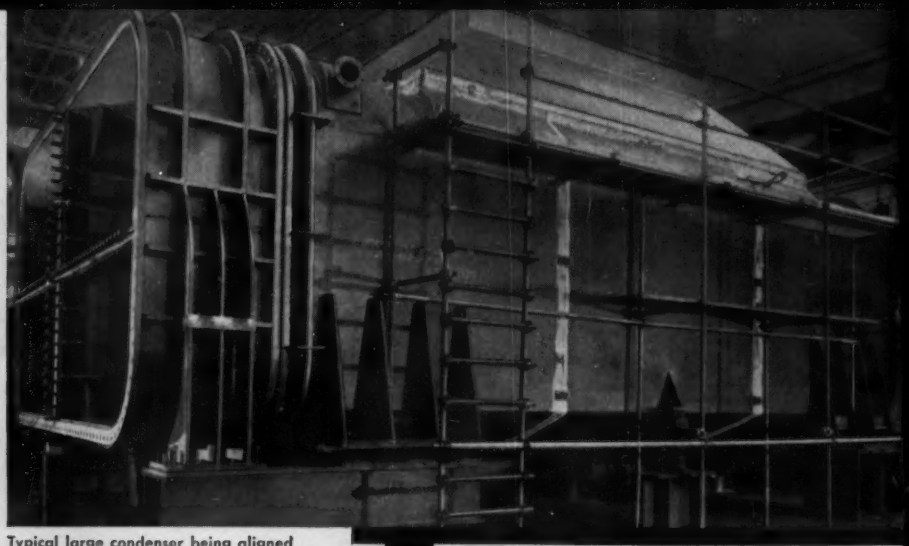


Tube-type Allis-Chalmers motors driving condenser cooling water pump.

Get the whole



Vertical mixed-flow circulating water pump and motor.



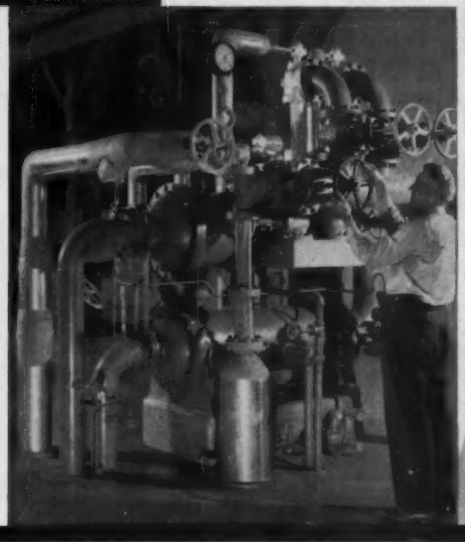
Typical large condenser being aligned in shop prior to shipment.

Two-stage rotary vacuum pump.

Condensate pumps and motors.

"ball of wax"

from Allis-Chalmers



Two-stage steam jet air ejector.

You get all that "unit responsibility" implies in coordination of original engineering, ordering, and installation with Allis-Chalmers condensing equipment.

For A-C builds the condenser with its auxiliary apparatus, including pumps, motors, air removal equipment, switchgear, etc. Moreover, the experience in building millions of square feet of condensers of every size, shape and type enables Allis-Chalmers to meet your special conditions with a high efficiency, high vacuum installation.

for information about Allis-Chalmers condensing equipment, call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-5355

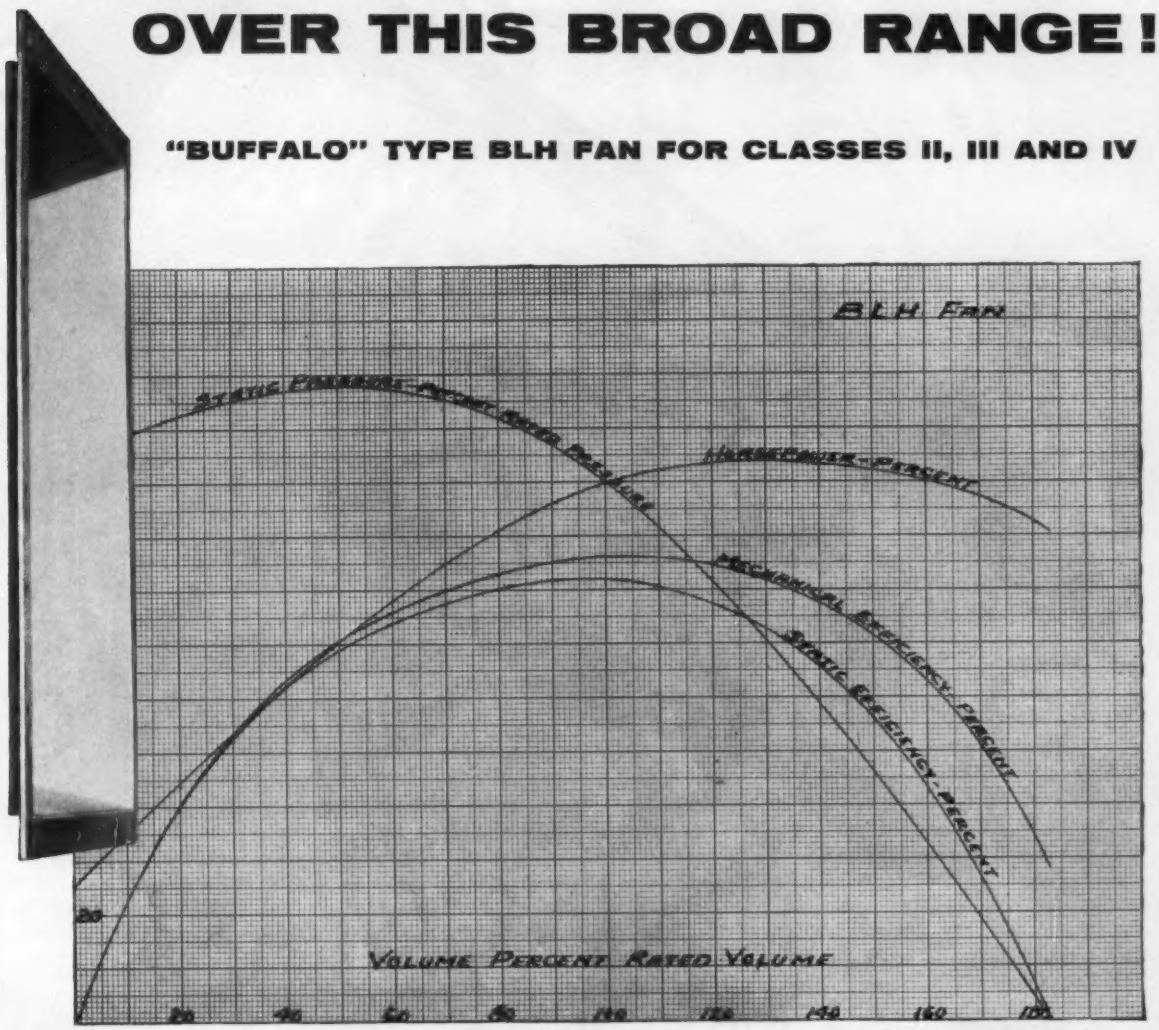
A NEW HIGH IN

"Buffalo" Type BLH Fan for high pressure air moving. Its efficiency is due to advanced rotor, inlet and outlet features developed exclusively by "Buffalo".

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT

FORCED DRAFT EFFICIENCY OVER THIS BROAD RANGE!

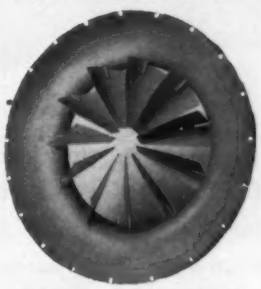
"BUFFALO" TYPE BLH FAN FOR CLASSES II, III AND IV



If peak efficiency, along with durability and servicability, are important to you in a forced draft fan, the BLH deserves your closest investigation.

Note the broad curve of mechanical efficiency above — 80% or better from 65% to 135% of rated volume — permitting flexibility of operation. This performance has been achieved through inlet-to-outlet streamlining — a smooth inlet bell, cantilevered inlet vanes, backward curve blades, specially curved rotor flange and divergent outlet — minimizing turbulence at every point to give air the smoothest ride ever. And the new "Buffalo" Variable Inlet Vanes can be substituted for the stationary inlet vanes for smooth draft control with no performance loss in open position.

The BLH is one of a complete *series* of "Buffalo" Draft Fans available to meet your draft requirements exactly, with no guess work and no compromise. Write for Bulletin F-200 and recommendations on your problem.



"Buffalo" Cantilevered Variable Inlet Vanes have no center ring to cause entry loss, and the control mechanism is out of the air stream, assuring smooth volume control without sacrificing fan performance.

BUFFALO FORGE COMPANY

BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

Now available from your jobber!

Reg. U.S. Pat. Off.

SCOTCHLOK Type R

BRAND

Electrical Spring Connectors

With "live" Spring Action!

The "live" spring action of new "SCOTCHLOK" Type R Connectors holds wires in a bulldog grip. The *feel* of turning on a "SCOTCHLOK" is a sound test of its holding power. Here's everything you need for a one-step pig-tail: positive, vibration-proof connection; reinforcing steel shell; tough, pre-insulated vinyl cover; and a neat, compact splice.

FEEL THE GRIP! TRY TO PULL THEM OFF!

Send For Free Samples! See for yourself how good "SCOTCHLOK" Brand Type R Connectors really are! Just write on your letterhead and we'll send you free samples for testing. Address: 3M Company, St. Paul 6, Minn., Dept. BV-37

The term "SCOTCHLOK" is a registered trademark of Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. Export Sales Office: 99 Park Ave., New York 16, N. Y. In Canada: P. O. Box 757, London, Ontario.

PRODUCTS OF 3M COMPANY

He's got a lot of P-U-L-L

4 tons for every POLE STAR TRANSFORMER

A shearing force of 8000 pounds is applied to the projection-welded lift lugs of Pole Star distribution transformers through 50 kva, assuring an average safety factor of approximately 13 times the weight of the transformer.

Lift lugs of Pole Star distribution transformers through 50 kva* are subjected to a shearing test that simulates a 4000-lb. "lift" for each lug. Depending on the weight of the transformer, this Pole Star production control assures an average safety factor of approximately 13.

The shearing force is produced by a hydraulically powered lift that pulls upward on the lugs (total pressure is 8000 lbs.) while the transformer tank is held firmly in place by means of the center rod and transverse bar visible above. This force is great enough to shear off any lugs that are not perfectly welded, so that no "borderline" cases can survive the test.

Even years after a transformer is installed, the reliability of lift lugs can be of extreme importance. (For example, the unit might be removed for replacement by a larger transformer, or for repainting.) To make certain that Pole Star quality will be maintained during the years ahead, every lift lug is coated with a long-lasting sealing compound before being projection welded. This compound prevents rust-weakening of the lift lugs by effectively blocking out moisture from the welded area.

**Different manufacturing and testing procedures are used for the lift lugs of larger transformers.*

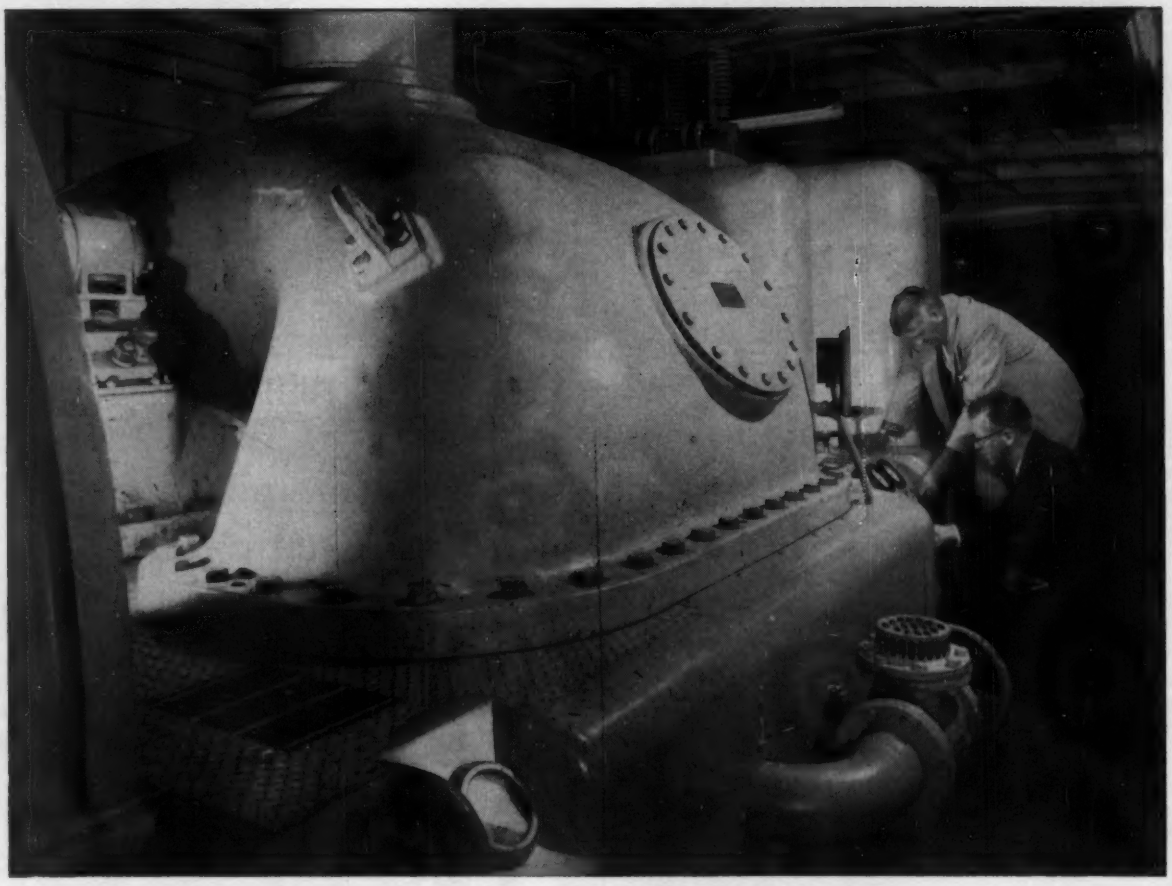
167 Production Controls make Pole Star Best!

POLE STAR

3 through 500 kva, through 67,000 volts

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division CANONSBURG, PA. Greater Pittsburgh District



Albert C. Rickborn, Plant Superintendent at Mississippi Power & Light Company, Jackson, Mississippi, and W. W. Wellington, Gulf Sales Engineer, discuss performance of Gulfcrest in one of this plant's three giant turbines. These units were installed in 1948, 1950, 1951—and Gulfcrest has protected all three from the beginning!

Only GULFCREST is Alchlor-Processed . . . for super performance!

Gulfcrest delivers superior performance—over long periods of time—in every type of steam turbo-generator. This incomparably pure turbine oil is super-refined by Gulf's exclusive Alchlor Process. Unstable hydrocarbons are removed by this process, then special inhibitors are added to increase oxidation stability, prevent foam and protect against corrosion.

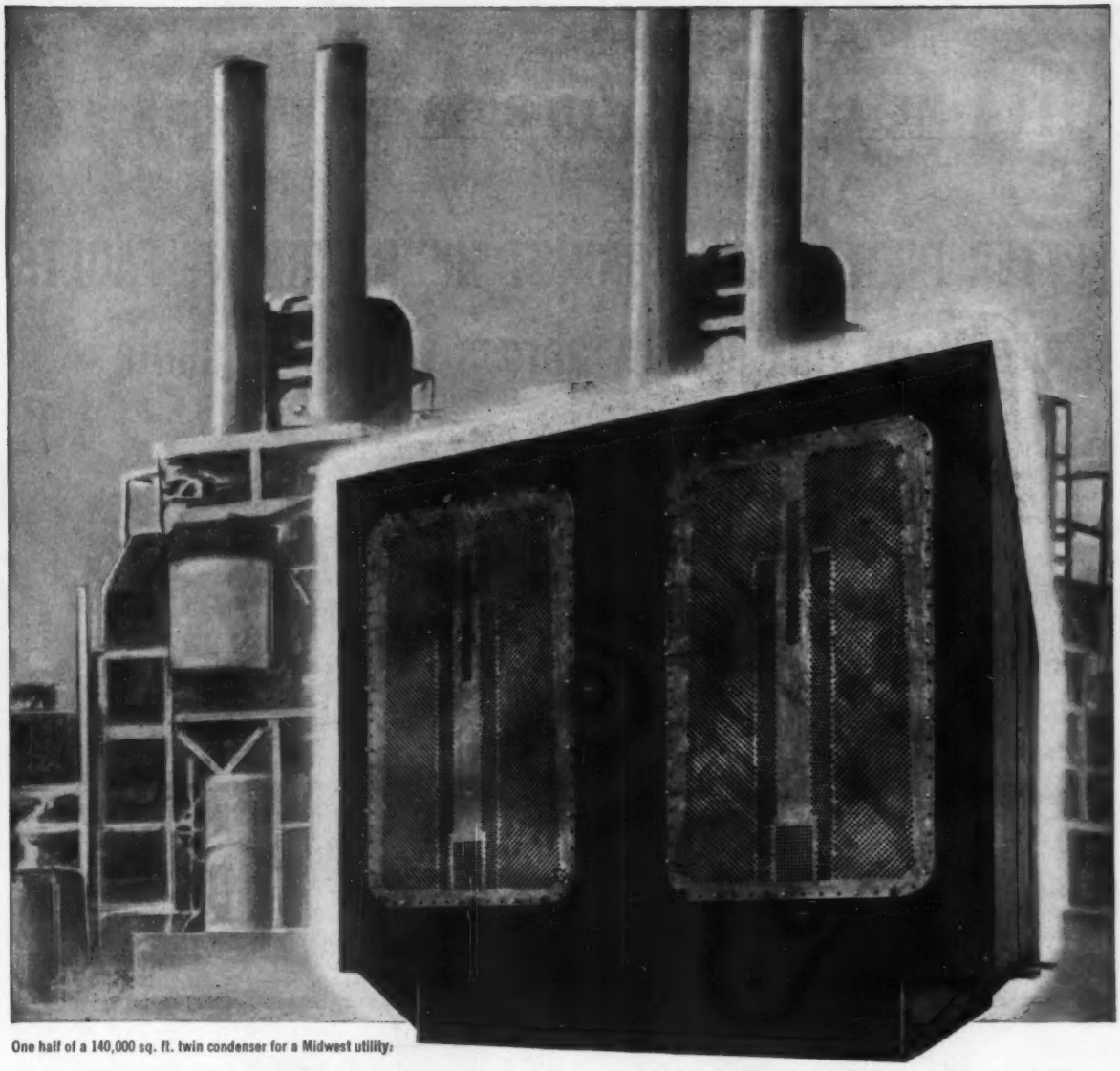
Gulfcrest has been in continuous service in several large turbines for over 20 years—without any significant change in its characteristics. And neutralization numbers of the oil remain remarkably low. Gulfcrest offers safe, sure turbine protection for many years . . . an excellent long-range investment!

Your Gulf Sales Engineer will be glad to recommend the proper grade of Gulfcrest for you. Just call your nearest Gulf office.

GULF OIL CORPORATION
GULF REFINING COMPANY
1822 Gulf Building
Pittsburgh 30, Pa.

GULF

THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS



One half of a 140,000 sq. ft. twin condenser for a Midwest utility.

C. H. WHEELER Principles of Steam Condenser Design Win Approval of Large Utilities

To help modern power plants conserve every BTU of boiler fuel C. H. Wheeler is working constantly to design and build more efficient steam condensers. Here are just a few of the more important features in C. H. Wheeler Dual Bank Condensers that are recognized by large utilities:

- *Deaeration . . . 0.01 cc per liter is attainable.*
- *"Zero" condensate temperature depression.*
- *Purity of condensate.*
- *Additional steam lanes shorten path and resistance to steam travel.*
- *Lower pressure drop and higher vacuum.*
- *Specifically designed for larger, more efficient electric generating stations.*
- *Adaptable to any station layout and designed to minimize field erection problems.*

C. H. Wheeler representatives are located in principal cities. Let us present a proposal for the most modern Steam Condenser, Pumps and Auxiliaries for your electric generating plants of tomorrow.

C. H. WHEELER MANUFACTURING CO., 19th & LEHIGH, PHILADELPHIA 32, PA.

Steam Condensers • Vacuum Equipment • Pumps for Circulating Water, Condensate, Water Supply and Drainage • Marine Auxiliary Machinery • Special Products for Atomic Service

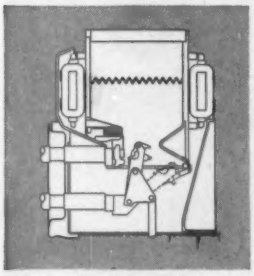
C.H. Wheeler OF PHILADELPHIA

METAL-CLAD SWITCHGEAR

BETTER PROTECTION AGAINST HIGH CURRENT FAULTS

uniform flux density across whole arc chute

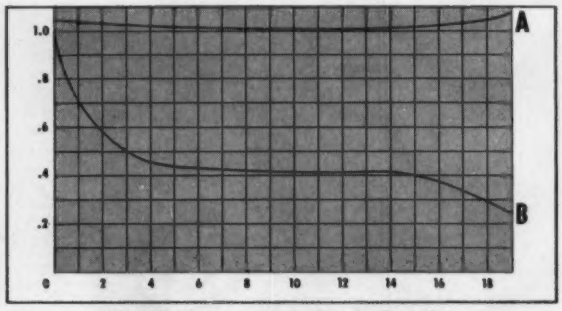
When a high current fault opens an I-T-E 15 kv circuit breaker, the arc is practically swallowed up in the arc chute—faster and over a longer path than has ever before been possible. The reason lies in two unique construction features found only in I-T-E circuit breakers:



Path of arc through chute equipped with twin coils.

1. Twin coils and closed loop magnet. Arc current through the twin blowout coils develops a stronger flux density that is uniform across the entire arc chute. Arc is stretched farther, faster—cooled and extinguished in less time. And the forward part of the arc chute comes into use just as much as the back part. So arc chute life is significantly prolonged.

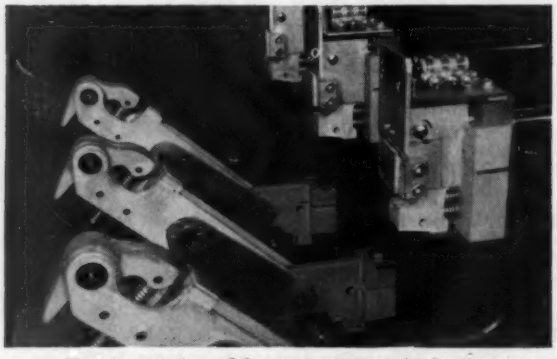
2. Laminated iron of transformer quality. This superior iron construction keeps losses to a minimum. Magnetic field is not only stronger, but rises and falls in phase with the current through the arc. Thus the greatest magnetic pull on the arc occurs when it is most needed—at the top of the current cycles. These are both extra-quality construction features of the sort you can expect to find in I-T-E switchgear. All together,



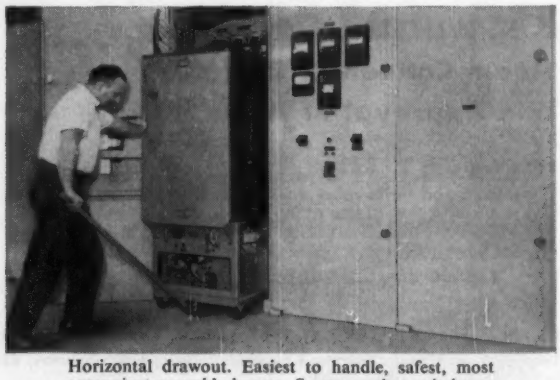
Flux density across entire length of arc chute.
A. Twin coil B. Single coil

I-T-E quality means generally superior performance, better endurance under handling, and longer life in service. Yet it costs you no more.

Get complete information on I-T-E metal-clad switchgear—and the many engineering services available to help you realize greater economy and satisfaction in a system that meets your requirements. Available in ratings from 2.3 through 13.8 kv, 50 through 750 mva interrupting, and up to 3000 amperes continuous. Write to I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Phila. 30, Pa.



Fast interruption of low current arcs. As breaker opens, pistons force a jet of air between contact points—driving arc up into arc chute.



Horizontal drawout. Easiest to handle, safest, most convenient assembly known. So strong that switchgear is shipped factory assembled and ready for installation.

I-T-E CIRCUIT BREAKER COMPANY—Switchgear Division

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CLOSED MAGNET LOOP
Laminated Iron
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NOW

connections that will last forever with

DOSSERT WELDING ALUMINUM CONNECTORS

the most diversified line for substations and generating plants

DOSSERT connectors offer economy as well as long service life. They can be simply and easily installed by inert-gas arc welding, resulting in an all-aluminum weld.

These aluminum connectors feature:

- no contact resistance
- minimum maintenance
- higher corrosion resistance
- greater structural strength
- neater appearance

We also welcome inquiries on modifications or applications.

50 YEARS OF TECHNICAL KNOW-HOW

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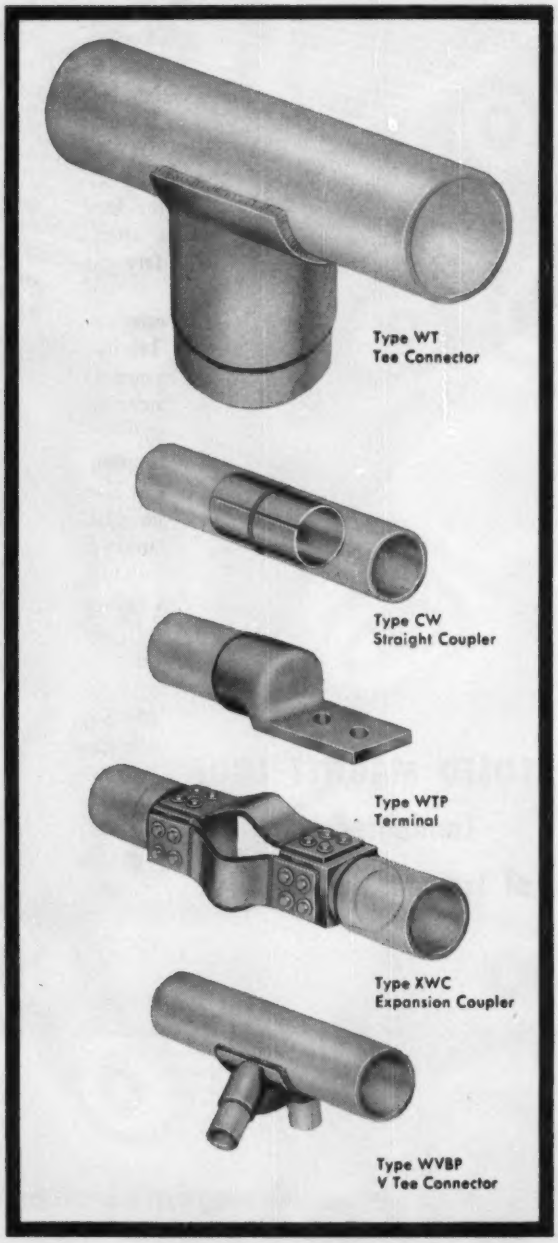

NEWS-SCOPE

FUTURE NEWS ▶ **Nuclear powered superheating** may be a possibility in one of the new A-plants now under consideration.

A forthcoming bill would automatically bar strikes in all interstate utilities until a President-appointed fact finding board can study grievances.

Higher cost estimates cause "agonizing re-appraisal" of two previously announced atomic power proposals. It may mean an entire new approach to these plant schemes.

LATE NEWS ▶ **New York State Republicans urge Gov Harriman's support** in drive to swing Congressional Democrats behind the Niagara compromise bill proposed by Senators Ives and Javits, and Representative Miller. This bill recommends State Power Authority construction and contains limited preference provisions.

Dr Hans A. Bethe of Cornell University testifies at AEC hearing that Power Reactor Development Co project will be safe in all respects. Hearing was called after three AFL-CIO unions challenged the Monroe, Mich., project on safety grounds.

Reclamation Bureau awards $48.9-million contract for construction of 465-ft high Trinity River Dam in California to six-company combination. Those in group are Guy F. Atkinson Co; M. J. Bevanda; Charles L. Harney, Inc; Ostrander Construction; A. Teichert & Sons; and Trepte Construction.

The rotating elements of Public Service E&G's 145,000-kw turbine generator No. 8 at Kearny Station have been returned to the manufacturer for repair of damage sustained Feb. 9 when an accident caused loss of pressure on the unit's main oil system. The unit is slated to return to service by June.

Allis-Chalmers has formed a Nuclear Power Division. The new component, fourth division of the Industries Group, will include the former nuclear power department and will be under J. L. Singleton, group vice president.

Colorado Supreme Court finds Intermountain REA guilty of trying to invade Colorado Central Power's area. IREA's construction of power lines parallel, for a half-mile stretch, to CCPA's was termed "unlawful acts reminiscent of the railroad wars of the 1870's."

Washington State Senate votes 42-2 to abolish the State Power Commission. The measure, now before the House, would authorize PUD's and municipal units to form jointly operated agencies which would assume the commission's functions.

A "three-part" railroad car to transport huge power transformers is slated to start operating this summer, reports Westinghouse. The car, which will carry units up to 500,000 lb, is being built by Greenville Steel Car.

First Boston Corp makes winning bid of 8.956¢ a share to underwrite the 1,507,304 common shares of Southern Co which is being offered stockholders through rights on a 1-for-13 basis, record March 13 to expire April 4 at $20 a share . . . Baltimore Gas & Electric Co is getting ready to offer up to 581,537 common shares under a rights offering.

ELECTRICAL WEEK

A TWO-MINUTE

NRECA MEETING ▶ **When some 5,000 farm folks get together** to talk about their electric power needs and problems you're likely to have a pretty lively session. The NRECA meeting in Chicago earlier this month was certainly that. The delegates endorsed a stepped-up public relations program, fussed over the prospect of higher interest rates on REA loans, again backed many federal power projects. For an interpretative report on the four-day meeting, **turn to page 58.**

EVENTS ▶ **"I hope that I shall someday see a power line unencumbered by a tree."** This wasn't quite the theme of the second Street Tree and Utility Conference held in Cleveland, but the reports certainly fell in that pattern. Utility men, arborists, and tree commissioners are making noticeable progress in their efforts to promote peaceful co-existence between street trees and power lines **(p 63).**

Electric companies, Reclamation Bureau, and a large G&T cooperative form a power pool in New Mexico in wake of drought scourge **(p 64).**

WASHINGTON ▶ **Congress makes its first foray** of the session in the federal power field with hearings on a government-financed Hells Canyon development. Although Idaho Power is already licensed and at work on the development, Sens Morse and Neuberger of Oregon and Rep Gracie Pfost of Idaho insist on being heard. In a related action, Iowa's Rep Ben Jensen told FPC to ignore Interior's plea to delay action on the Mountain Sheep and Pleasant Valley projects also on the Snake River. Pacific Northwest Power Co is asking for federal licenses for these two projects **(p 62).**

GENERATION ▶ **The new 138-Mw Dean H. Mitchell steam station** on the Northern Indiana Public Service system has a number of site advantages. It is only five miles from a heavy load center (Gary Steel Mills). It has ample cooling water and rail facilities available. Barging facilities can be added. But designers had their troubles. They had to use some 70,000 ft of H-piles and 400,000 cu yd of slag to stabilize the foundation in a former inland lake. Switchyard facilities were designed to minimize difficulties from dust emitted by a nearby cement plant. And special short, high-velocity stacks were required to keep within height limits of a local ordinance **(p 72).**

To fit new water wheels on old shafts at two Pacific Gas & Electric hydro plants, engineers had to shrink the shafts with dry ice and expand the hubs with strip heaters **(p 86).**

SUBSTATIONS ▶ **Lighter, lower-cost transformer** is the newly designed potential unit with cascading windings for use on circuits of 115 kv and above. Article shows winding diagram and discusses applications. The transformer is about ⅔ as high and has ½ the weight of a conventional transformer **(p 83).**

Two-year performance records on the 330-kv dead tank oil circuit breaker on the Ohio Valley Electric Co system indicate the basic principles will apply equally well at 440 kv and higher. The breaker bushings—some 230 in service—have 100% performance records with almost no radio influence. What's more, it's reported that breaker tanks for 440 kv could be produced at existing facilities and would come within railroad clearance limits **(p 76).**

DISTRIBUTION ▶ **Now it looks as if there is a chance of easing that summer peak** load worry right at the source—in the packaged room air cooler, itself. Author William L. McGrath of the Carrier Corp tells of a new cooler design that minimizes the differences among the starting, maximum demand, and running currents of

room-type conditioners. He says there's a chance of getting 15-20% more cooling for the same installed kva **(p 78).**

SELLING ▶ **Looking for a way to add a few hundred industrial lighting salesmen** to your forces without increasing your payroll, better see **page 70.**

Live Better . . . Electrically promotion lines up powerful industry association support for its 1957 run. There's EEI, American Bankers Association, American Home Lighting Institute, National Rural Electric Cooperative Association, and a number of others **(p 96).**

Talk about novel industrial applications of electricity, did you know that an electric "blanket" is used to help bond the stainless steel leading edge on helicopter blades? That's just one of the uses of electric heat that is being made by Kaman Aircraft in its helicopter plant . . . Want to read a pipe dream about the dust bowl **(p 102).**

MANAGEMENT ▶ **Electric company security offerings totalled some $160 million** last week—making it one of the busiest single weeks in the market for our industry. Early reports indicated the market was able to absorb these with little difficulty at going prices . . . Seattle City Light puts in new rate for industrials to provide lower monthly minimum charge when consumer avoids maximum use during peak hours . . . Some eye-catching annual reports are coming in—fodder, certainly, for the annual report contest **(pp 135 and 136).**

An inventory recession, such as hit in 1953-54 is not in the offing. Part of the record inventory build-up which shows in surveys is due to price increases rather than accumulation of materials and finished goods. And much of it is in industrial areas where sales are moving along **(p 133).**

PEOPLE ▶ **Promotions: At Western Massachusetts Electric,** J. William Bennett is new engineering vp, Marlowe G. Moses is chief engineer, Harold Perry is new general purchasing agent, and Russell D. Purrington is new sperintendent of steam production. At Wisconsin P&L, C. C. Merrmann is new financial vp and treasurer **(p 140)** . . . At Central Maine Power, George A. Hills is new purchasing agent **(p 142).**

MANUFACTURERS ▶ **American Gage & Machine Co buys Standard Transformer Co** and installs Chester F. Buckley as president . . . Line Material Industries participated in the recent patent exhibit at the Commerce Building in Washington . . . A vacuum tube interrupter switch with ratings up to 230 kv has been developed. Setup consists of a series of vertically stacked vacuum tube switches along with a conventional disconnect switch **(p 124).**

NEW EQUIPMENT ▶ **Group-operated air break switches,** designed for vertical phase-above-phase mounting on single poles, are available in 2 and 3-way models. Ratings are from 7.5 through 69 kv at 400, 600, and 1,200 amp . . . New metering units for indoor or outdoor use are smaller and lighter than conventional units. The new ones are oil filled and have current and potential units in a single case. They are available for 25 through 69-kv service with primary ratings from 10/20 through 400/800 amp . . . New style bench test sets for calibrating ac and dc field instruments are on the market **(p 106).**

READERS FORUM ▶ **University of California professor** reports growing interest among engineering students in power curriculum **(p 148).**

ENGINEERING TRENDS

Modulated light beams can serve as communication channels for voice or other intelligence over line-of-sight routes. Transmission and reception are both accomplished with optical lenses and mirrors which are smaller and more readily portable than their radio counterparts. High efficiency is claimed for distances of "several miles" and multiple transmissions are feasible in a narrow beam.

Turbine-generator designs reflect growing trend to outdoor installation. Enclosures once required to make indoor machines suitable for exposure to the weather have been obviated to the point where access openings to the slip rings are about the only place where special treatment is required. If slip rings can be eliminated, then machines can be made identical for either indoor or outdoor use.

Radiation exposure of material adjacent to a reactor causes radiation damage, thermal stress from radiation energy, and accelerated corrosion.

Thin metal films provided for electrical resistance or light reflection properties in electrical and electronic instruments should be aged before calibration to insure long-term dependability.

Milled peat will fuel Ireland's "cheap fuel" project at Ferbane. A year's supply has been dug from adjacent bogs, and the plant will be given preliminary tests shortly, reports *Electrical Review*.

FROM EDITORS IN THE FIELD

Concrete pilings poured in place support a 138-40-13-kv substation erected in a filled area by an Ohio utility. Pilings are placed by injecting a cement mix through a hollow auger as it bores to any necessary depth in the fill. The cement combines with the fill material to form concrete.

Completely automatic spinning reserve is provided for Central Maine Power Co by a hydro stand-by unit which "motors" on the system until an emergency occurs. Control for this unit, activated by a drop in frequency, swings it from motoring to 30,000-kw generation in less than 10 sec.

TV provides remote observation of unattended-substation meters and controls in a new supervisory system under study by Georgis Power Co. Microwave will provide the control channels.

Hi-tensile bolted steel joints supplant riveting for the columns and beams of Connecticut L&P Co's addition to Devon steam plant. Such joints do not loosen from vibration because the nuts are tightened to pre-determined torques with air wrenches. And eliminating the specialized job of riveting saves erection time and cost.

STRAIN + TIME = WHAT?

Time-Loading Test Confirms Stable Strength of the Porcelain in O-B Insulators

Is the strength of porcelain *always* the same? That's what we are finding out in this test. Is porcelain stronger under a quickly-applied load than under a long-sustained one? Obviously, this could mean a lot to the man using strain insulators.

So far, it has been largely a matter of opinion (nothing can happen to porcelain!) But our ceramic research men take the attitude that something is liable to happen to anything. Hence, this painstaking, time-consuming, hair-splitting series of time-loading tests.

Porcelain, under a sustained load, does have lower strength, as do most other solid materials. But the difference is hardly measurable. It is completely smothered under safety factors.

-- So, it looks like a lot of wasted time; like an anti-climax, but it's just as important as a major discovery. There was an un-answered question. We ran it down. And we are glad it turned out as we expected.

Someday you may have some question about your insulators. Consider the value of doing business with a company that digs deep to provide competent answers. This is one of the unseen things in the package that gives you more for your money when you specify O-B insulation.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

TECHNICAL COMPETENCE

Ohio Brass

4818-H

THE HEART OF EVERY (B) INSULATOR

Q. what's he designing . . . insulators or hardware?

A. it may be either one . . . he designs both.

In the O-B engineering department, designs for insulators and hardware often come from the same drawing board.

An engineer in charge of developing transmission and distribution materials may work on a clamp one day, and on an insulator the next day.

It's significant that he works on both. And it's logical. Insulators and hardware work together in service. Why shouldn't they be designed by the same person?

Thus single responsibility begins even before the products are made. It carries through designing, manufacturing, testing . . . and, most important, performance in service.

We're concerned with how good is the hardware, and how good is the insulation. But our main concern is with how good they will work together.

The one company that designs and makes both insulators and hardware is Ohio Brass.

4746-H

Ohio Brass

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DODGE *PowerGiants*

Dodge T700
Tandem

Dodge P300
Forward-Control

Dodge 600
with Van Body

Special bodies fit readily
on any Dodge chassis

Dodge 500
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with Beverage Body

MOST *POWER* OF THE LOW-PRICED 3

Dodge T900
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Dodge 100
Panel

Dodge C.O.E. 700
Tractor

Dodge 800
Tractor

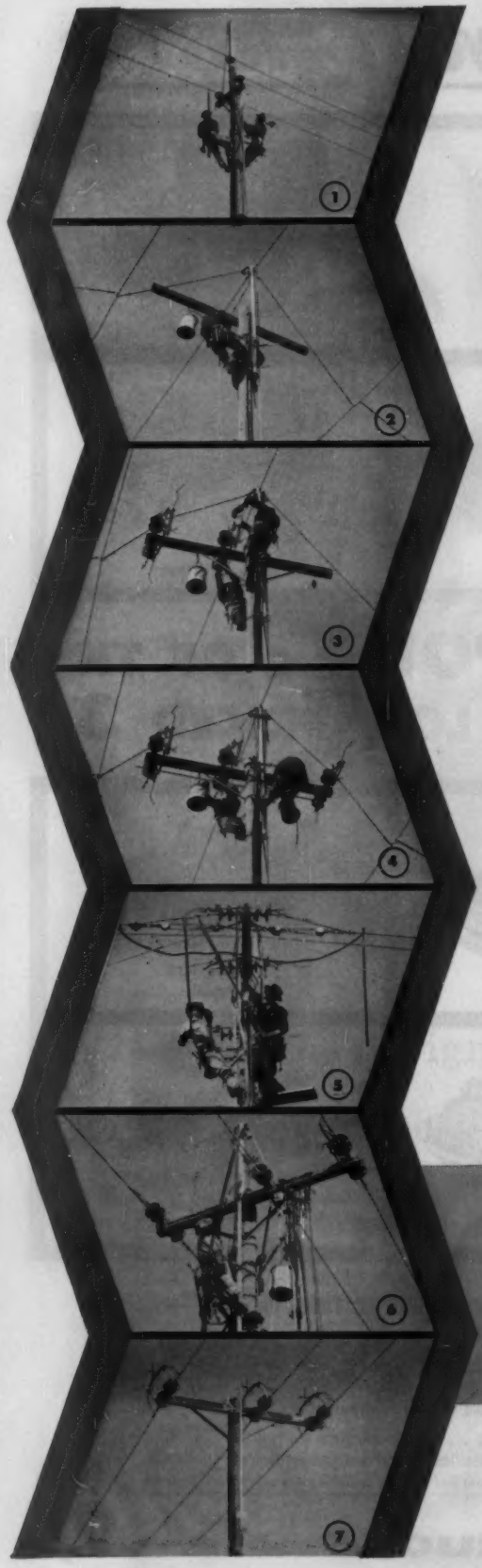
In every weight class

Dodge Power Giants give you an extra bonus of power.

From 204-hp. pick-ups to 232-hp. tandems, Dodge V-8's outpower the "other two" by as much as 31%. This extra power reduces engine strain, saves wear. What's more, Dodge engines, both V-8's and 6's deliver full power on regular gas.

Dodge hauls more payload, too . . . up to one-third more. And Dodge offers major advantages in driving ease, cab comfort and prestige-building good looks. See for yourself. Your Dodge dealer has a Power Giant to meet every trucking need.

DODGE TRUCKS WITH THE *FORWARD* LOOK



22 KV HOT LINE SWITCH INSTALLATION

in less than 6 hours

A unique feature of KPF Air Break Switches is the ease with which they can be installed on hot lines. An important reason for this convenience is the simple design of KPF switches. They consist of two rigid dead end insulator assemblies with rigid jumpers forming the switch arms. One assembly is mounted stationary to the cross-arms. The other rotates to make and break the circuit. There are no complex parts to get out of order, require lubrication, adjustment or service. KPF switches serve indefinitely, are shipped ready for use requiring only bolting to the cross-arm and connection of conductors.

Pictures alongside illustrate a 22 kv hot line installation typical of those made regularly by leading power companies using KPF switches.

1. Line crew on job at 8:30 A.M. Gin pole installed and linemen start to untie and spread hot 22 kv line 3/0 copper. **2.** Line wires spread and new cross-arms installed for KPF switch. **3.** Switch being installed. **4.** Switch installed and adjusted ready to cut-in. **5.** Bypass jumper and blocks installed. Lineman about to deadend 3/0 copper into automatic deadend attached to KPF switch. **6.** Lineman lowering last conductor into position to be cut into switch. **7.** Switch complete and ready for operation. Time 3:10 P.M.

Get catalog, complete specifications. Write direct

KPF

AIR BREAK SWITCHES

Standard for nearly half a century

KPF ELECTRIC COMPANY

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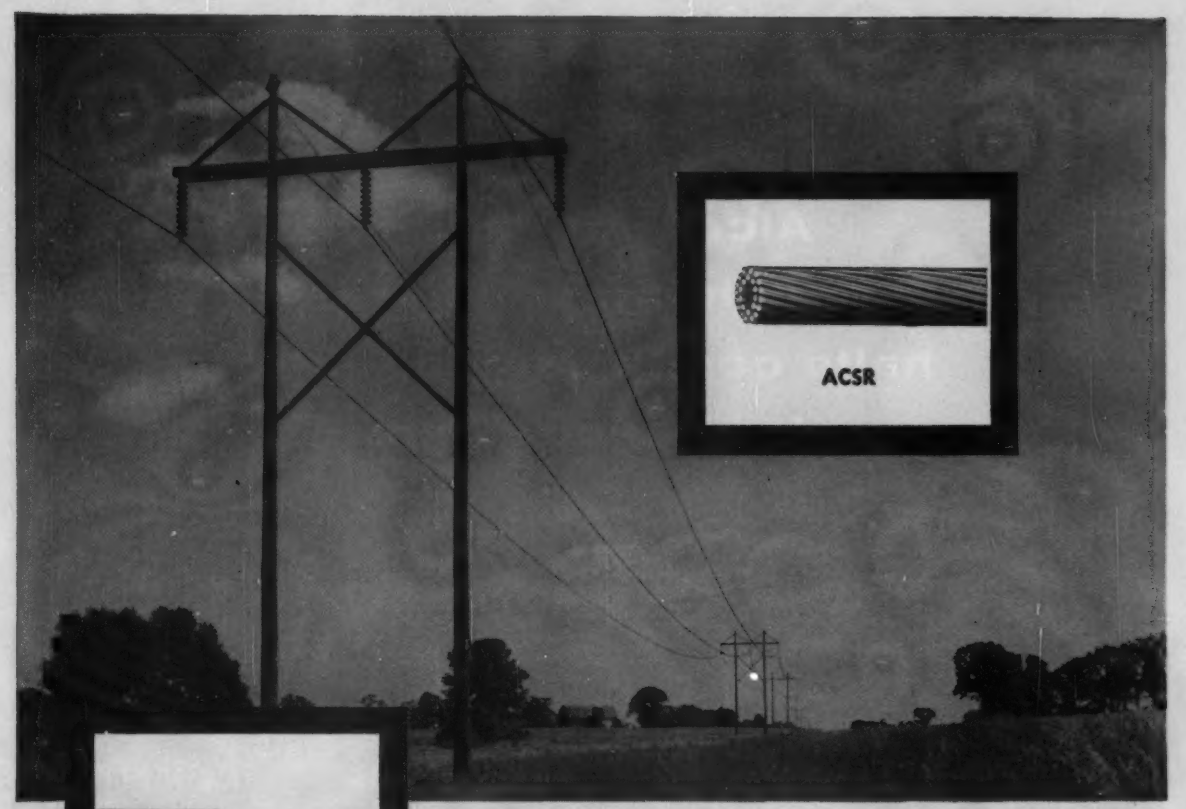
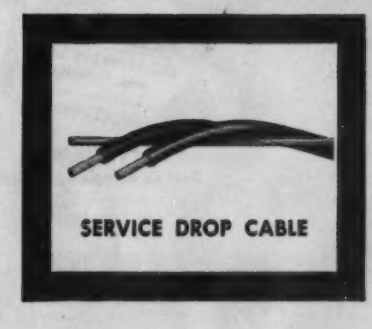


GENERAL CABLE ALECTRAL ALUMINUM CONDUCTORS



Consistent, outstanding performance mark General Cable's ALECTRAL Bare and Insulated aluminum conductors. Manufactured to General Cable's high standards in all sizes. Bare ACSR and aluminum • Weatherproof aluminum and ACSR conductors • All types of service drop cables. ALECTRAL is available with a complete range of paper, rubber and thermoplastic insulations, backed up by over 75 years of General Cable's engineering and manufacturing experience.

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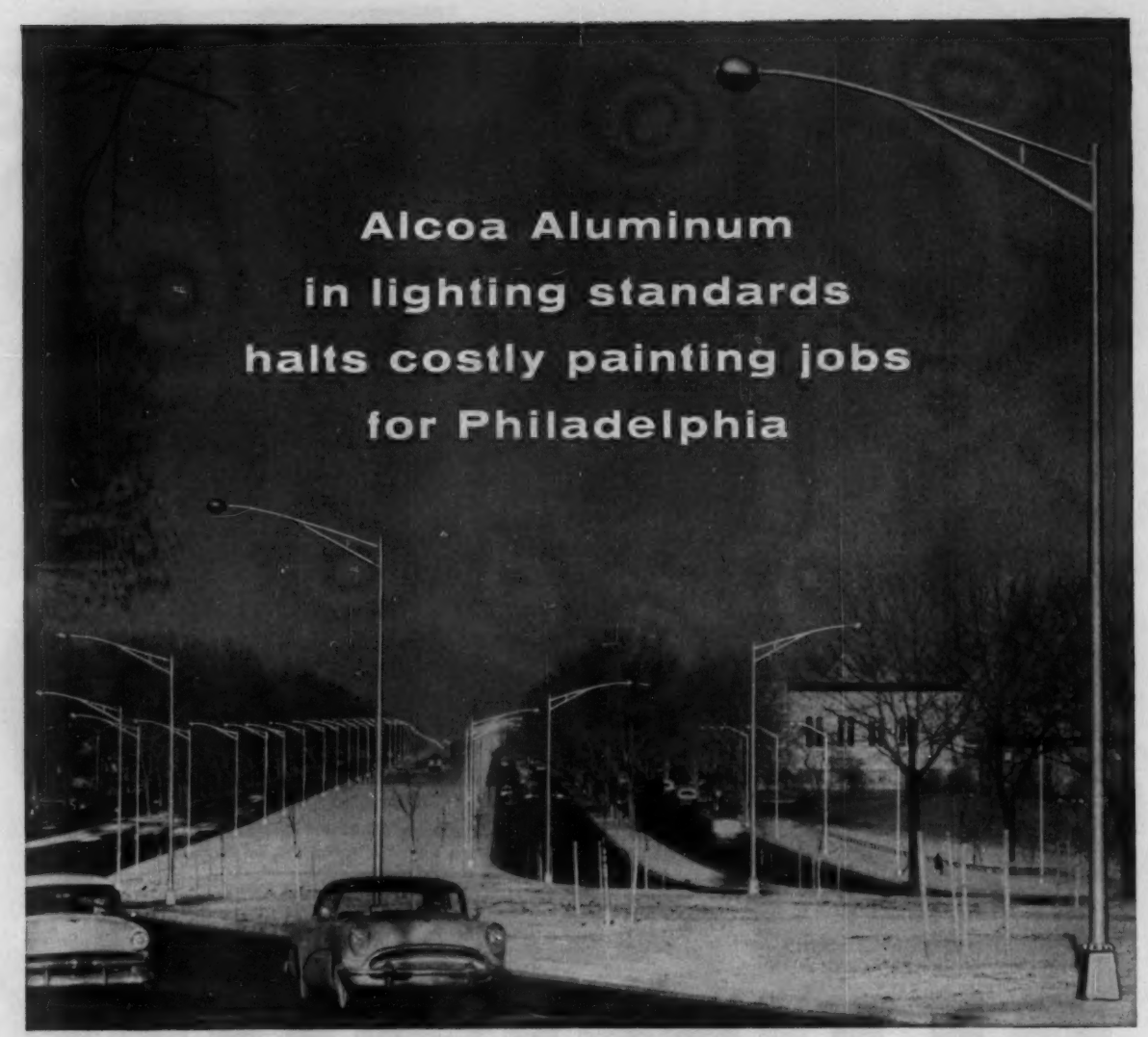
for quality and service . . . specify **GENERAL CABLE**



When Philadelphia relied on steel for lighting standards, each pole ran up a contract painting maintenance bill of $12.00 every two or three years. This ended in 1951, for in that year the City of Philadelphia switched 100% to lighting standards of aluminum . . . both for replacements and new installations.

That means no more painting—ever! Aluminum is free from corrosion that weakens wall strength and ruins appearance. No scale piles up in the interior to threaten electrical circuits. And light weight makes erection so inexpensive that first cost is generally comparable with cheaper but heavier metals.

Philadelphia already has 3,000 aluminum lighting standards in service. Included are 1,000 on beautiful Roosevelt Boulevard and another 500 at National Airport, where even the 92 mph winds of "Hurricane Hazel" inflicted no damage. Hundreds more are due for installation as the city remodels its lighting system.

Alcoa® does not make lighting standards, but supplies aluminum for their manufacture to leading companies. For the names of these firms, write to: Aluminum Company of America, 1977-C Alcoa Building, Pittsburgh 19, Pennsylvania.

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Your Guide to the Best in Aluminum Value

THE ALCOA HOUR—
Television's Finest Live Drama—Alternate Sunday Evenings

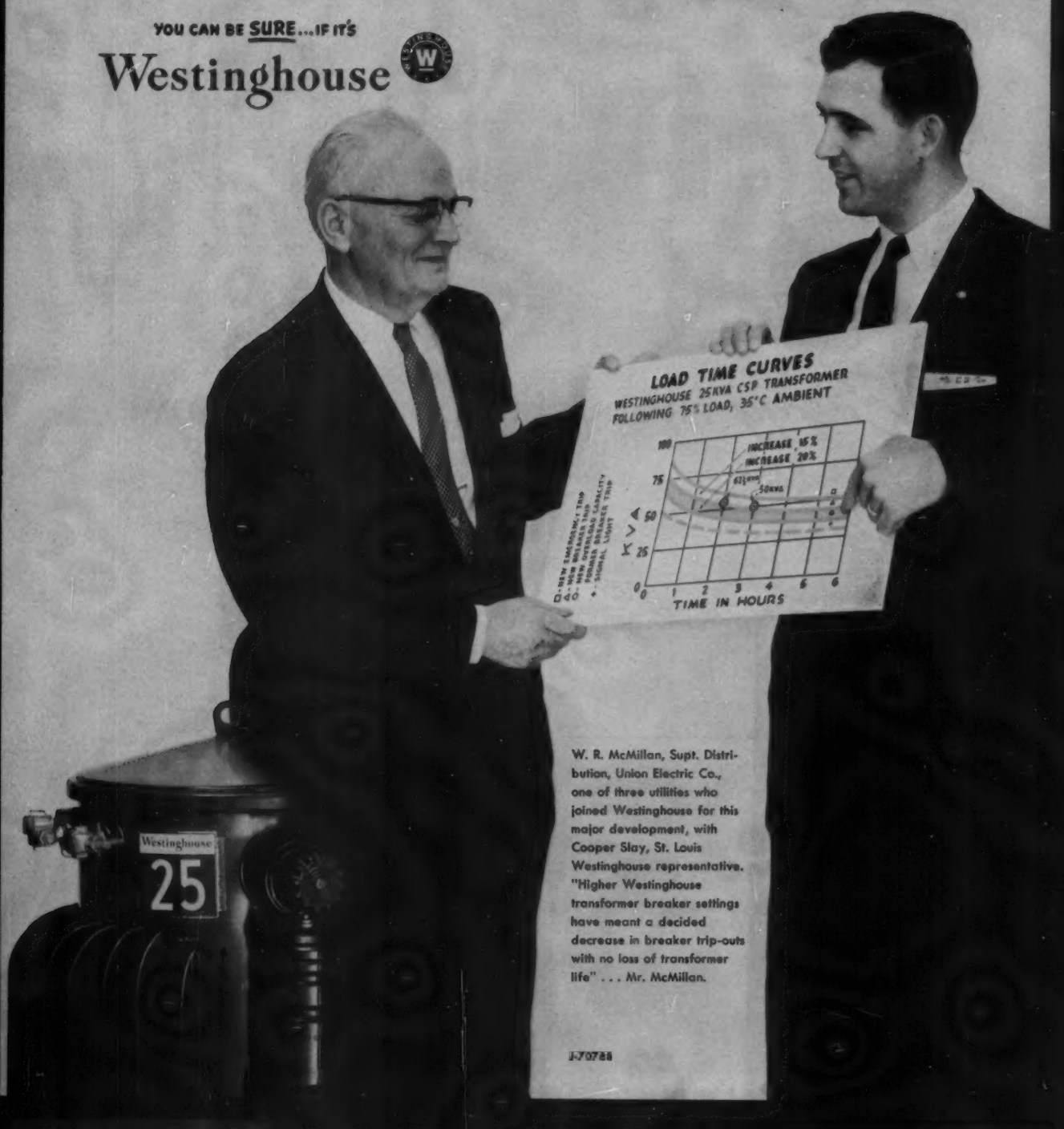
Your Westinghouse representative can prove . . .

20% INCREASED OVERLOAD CAPACITY

in all new Westinghouse distribution transformers *without sacrifice of service life!* The evidence is several thousand Westinghouse transformers with increased breaker settings put on Union Electric's lines, many since 1954, without a single burnout.

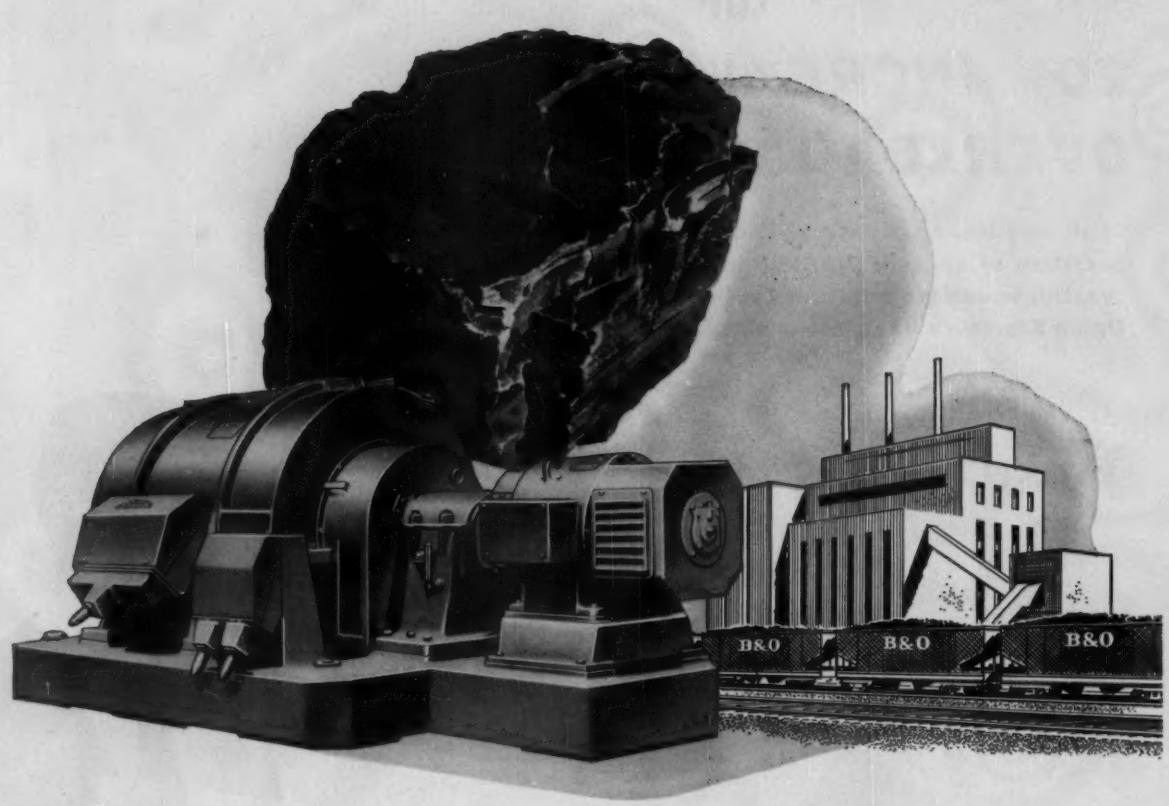
YOU CAN BE SURE...IF IT'S

Westinghouse



W. R. McMillan, Supt. Distribution, Union Electric Co., one of three utilities who joined Westinghouse for this major development, with Cooper Slay, St. Louis Westinghouse representative. "Higher Westinghouse transformer breaker settings have meant a decided decrease in breaker trip-outs with no loss of transformer life" . . . Mr. McMillan.

J-70788



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Coal-generated electric power is continually on the increase because Bituminous is economical and abundant. Billions of tons in proved reserves of bituminous for every purpose are available on the B&O. Mines operated with modern efficiency are prepared to provide the right coal for your specific needs. *Ask our man!*

LET OUR COAL TRAFFIC REPRESENTATIVES suggest the B&O bituminous you can bank on. Contact Coal Traffic Department—B&O Railroad, Baltimore 1, Md. LExington 9-0400.

BALTIMORE & OHIO RAILROAD

BITUMINOUS COALS FOR EVERY PURPOSE

A motor that's so "quiet"
—*you can have a conference beside it...*

it's the ELLIOTT "super-quiet" 2-pole motor!

Here are some of the typical comments made at recent demonstrations of Elliott's new "super-quiet" 2-pole induction motor.

"*The noise level is out of this world*"
"*What more could you ask for in a motor?*"
"*The kind of motor I've always dreamed about.*"

They're absolutely right. The improvement in the quality and level of sound is astonishing, in fact—*out of this world.* On the job, these giant-sized "super-quiet" motors boost operator comfort and efficiency and promote better human relations throughout plant and community.

What's more, Elliott's advanced design permits faster, simpler upkeep. Ease of access for routine inspection, cleaning and maintenance is what the industry once only dreamed about.

But such revolutionary design changes don't happen overnight. Elliott engineers were grappling with these problems as early as 1931. After long years of acoustical research they "licked" noise problems at their source. This was accomplished by advanced studies of induction motor design which led to the redesigning of certain components of the rotor, stator and ventilating system. Only recently did this research and experimental testing reach the desired perfection to allow its presentation to the public.

Since then, demonstrations of the newly-designed, 2-pole motor have brought unanimous acclamation. Orders are coming in from all over the country and the response following installation is unprecedented. Like one of our visitors said—*what more could you ask for in a motor?*

"It's really quiet—the way I like it!"

ELLIOTT Company
RIDGWAY DIVISION
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R7-8

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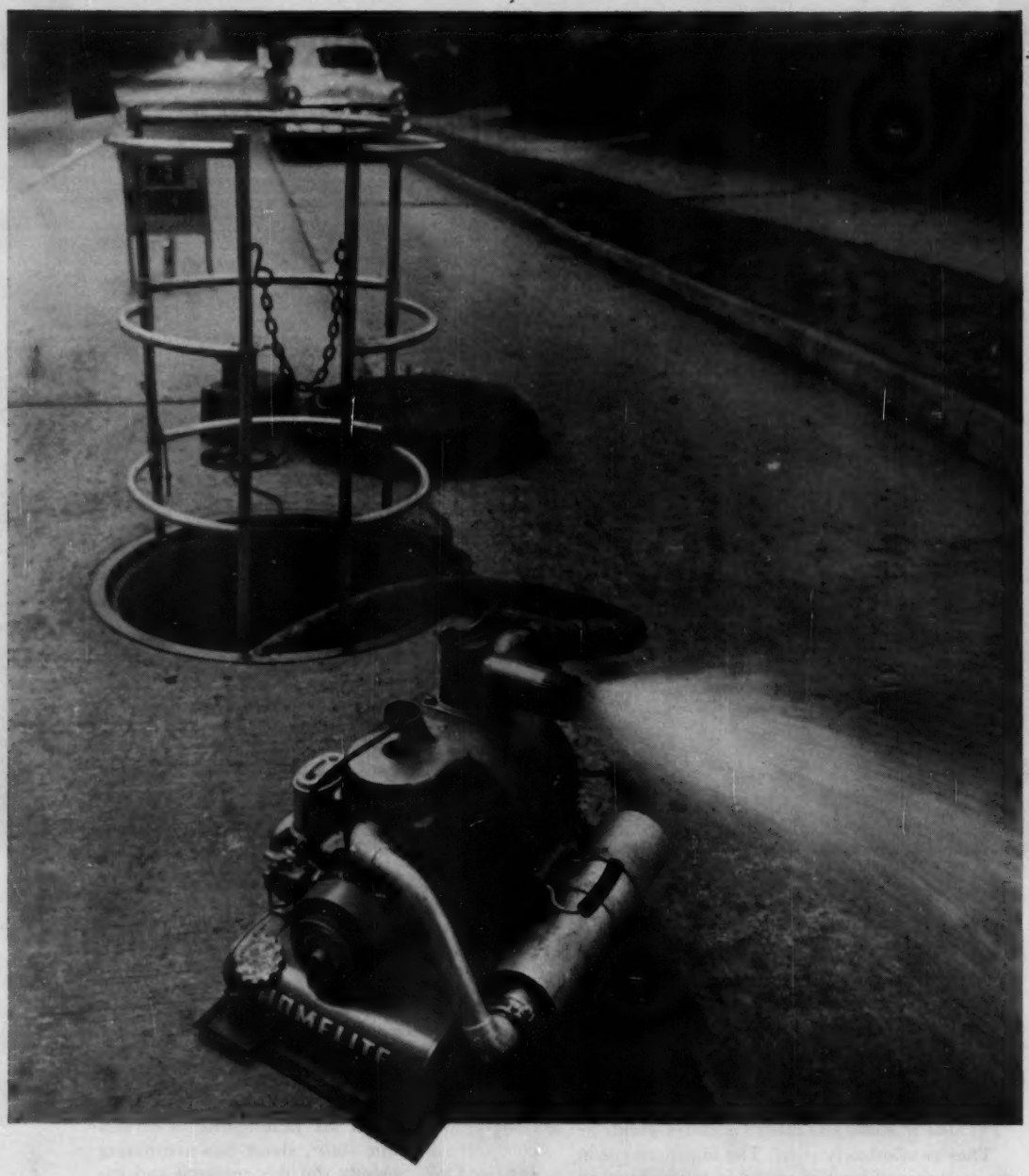

New HOMELITE Pump

Whispers While It Works

Goodby residential complaints! Here's a new lightweight gasoline engine driven pump that takes it easy on the neighbors' ears. Yet handles any water problem . . . from seepage to volumn pumping! The new Homelite Model 36 S2 2″ self priming centrifugal Pump operates at slow speed with low noise level yet has high capacity of 9000 gallons per hour. It weighs only 85 pounds and can be easily carried by one man to the best pumping location. Starts quickly, primes automatically, gives long, dependable and trouble-free service under the toughest conditions. Ask your Homelite Representative for a free demonstration. You'll find a good neighbor policy in every pump.

HOMELITE

A DIVISION OF TEXTRON INCORPORATED

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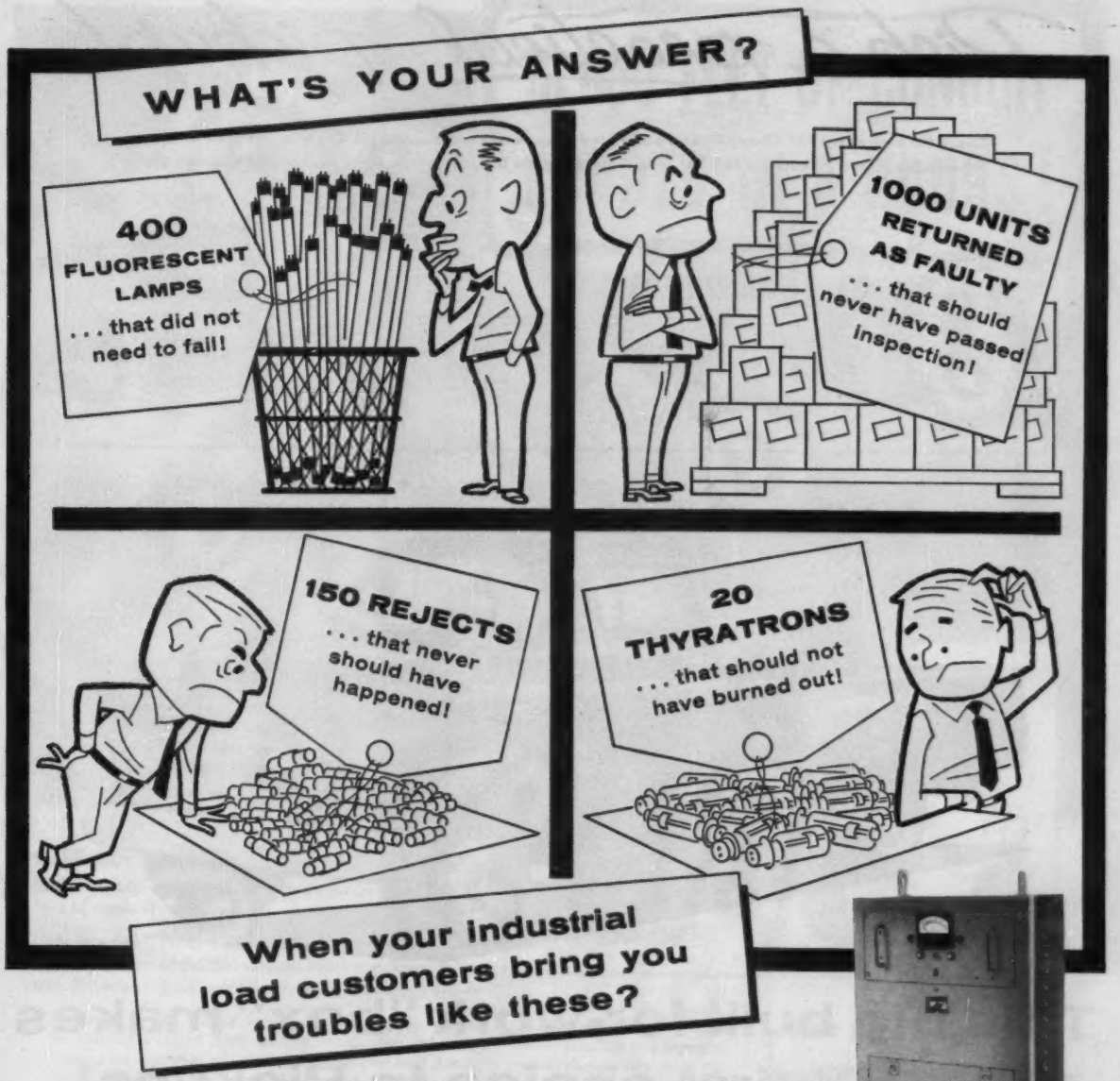
WHAT'S YOUR ANSWER?


400 FLUORESCENT LAMPS . . . that did not need to fail!
1000 UNITS RETURNED AS FAULTY . . . that should never have passed inspection!
150 REJECTS . . . that never should have happened!
20 THYRATRONS . . . that should not have burned out!

When your industrial load customers bring you troubles like these?

Mr. Public Utility Industrial Salesman: Every one of those production and maintenance troubles plus many, many more — can be caused by voltage variation within so-called "allowable" limits! Those voltage variations can be prevented by automatic voltage regulation.

Voltage regulation is no longer a luxury! Any electrical device operates better . . . lasts longer when it runs continuously at its nameplate rating. Alert management is becoming more and more aware that voltage regulation decreases maintenance costs and prevents production losses. They will look to you for guidance.

STABILINE
type EM 6220Y
holds output voltage constant . . . ends production and process troubles.

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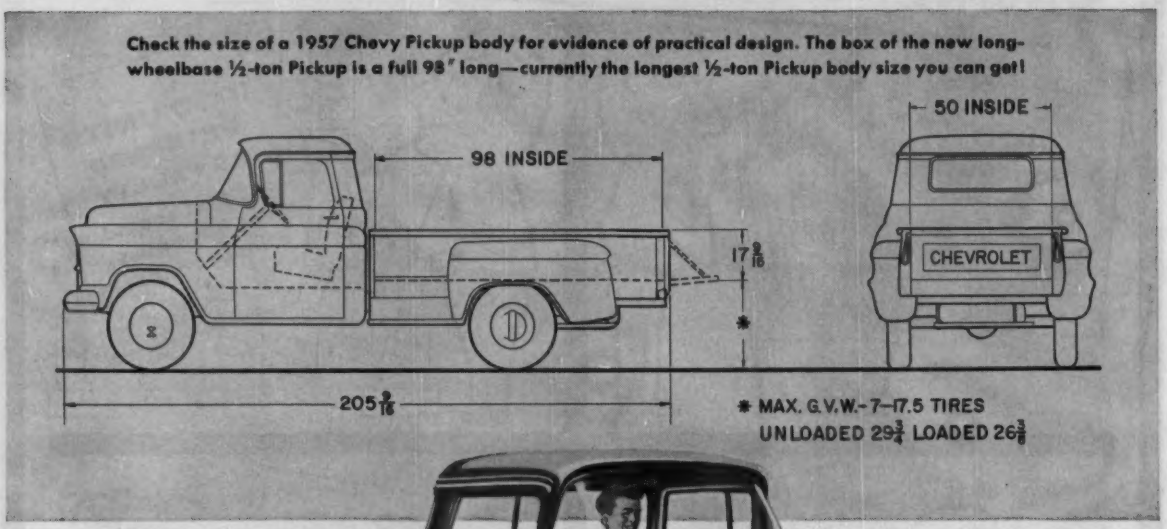
Pick a practical pickup!


Check the size of a 1957 Chevy Pickup body for evidence of practical design. The box of the new long-wheelbase ½-ton Pickup is a full 98" long—currently the longest ½-ton Pickup body size you can get!
98 INSIDE
50 INSIDE
17 9/16
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205 3/16
* MAX. G.V.W.-7-17.5 TIRES
UNLOADED 29 3/4 LOADED 26 3/8

This big built-for-work "box" makes CHEVY first choice in Pickups!

These best selling '57 Chevrolet Pickups are practical trucks in every respect. They offer modern power to keep your costs down low, modern looks to keep your prestige up high... and all these modern body advantages to help you make light work of tough jobs!

They're the most practical and profitable Pickups going! For example, they enable you to load more easily and quickly, thanks to *low* loading height and steel skid strips in the long-lasting hardwood floor. And for your bulkiest loads, stake pockets accommodate the addition of racks or side boards. Other modern advantages include extra hauling space provided by *outboard wheel housings* . . . a grain-tight tailgate with anti-rattle latch that strengthens the sides . . . and practical level-ledge side panels. Chevy gives you running boards, too, for convenient side loading. These new Pickups come in a wide range of ½-, ¾- and 1-ton models with spacious boxes ranging up to more than 9 feet in length. See your Chevrolet dealer for the one that suits your job. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

'57 CHEVROLET TASK·FORCE TRUCKS

PROVED ON THE ALCAN HIGHWAY . . . CHAMPS OF EVERY WEIGHT CLASS

CHEVROLET

10,000 FEET OF CONDUIT RODDED IN 8 HOURS!

Pick-up and Leader fittings meeting

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.

EASY DOES IT!—It's all in a day's work with Electroline Steel Duct-Rodding Equipment rodding 10,000 feet of conduit!

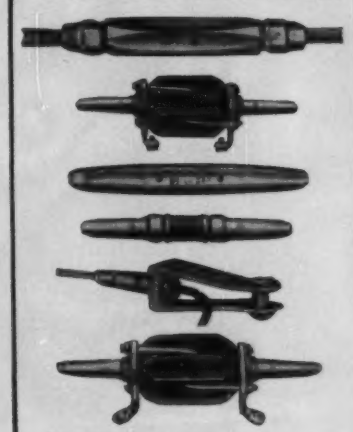
Light in weight, easily handled and stored, low upkeep: these are a few of the advantages utility men know to be true. But even bigger, more important advantages are—

- *Savings in the cost of labor*—for example, where it formerly took two gangs from one to two weeks on a given job, one gang, *in one-half hour*, has completed the same job—using Electroline Duct-Rodding Equipment.
- *Savings in original cost*—you get long life—double that of other types—when you buy Electroline Duct-Rodding Equipment. Add to that this fact: this equipment costs just about half as much for equivalent capacity! *There's true economy.*
- *Savings in Total Investment*—fewer sets are required because of the speed with which a job is completed and the equipment moved to other locations.

Speed up installation, reduce your costs; start now to use Electroline Duct-Rodding Equipment. Available for 3", 3½" or 4" Duct.

We've got a 4-page brochure which describes and illustrates more completely how this equipment can benefit you. We'll gladly send you a copy. Write us.

OTHER *Electroline* PRODUCTS



Electroline Company

4121 South La Salle St., Chicago 9, Ill.
In Canada: POWERLITE DEVICES, LTD., TORONTO

If you want to be sure
install Tiger Brand

Cable is pulled through the racks. Pulleys ease it through at each turn.

SINCE we've been making electrical cable at American Steel & Wire since 1891, customers often ask us how they can best plan for *future* wiring needs. They've seen the shocking cost of plant modernization programs in buildings that were not designed with foresight.

Electrically speaking, you're going to need a *flexible* wiring system, one that can be enlarged or revamped with ease. To lots of designers today, that means a feeder system that is *not* permanently sealed in rigid conduit, frequently buried under tons of concrete and, in case of damage, frequently unrepairable. All of these problems are solved when you install flexible Armorlokt in an open-rack system.

Initial installation is not difficult. Extra feeders can be added easily at any time. Special feature: Splices can be made *anywhere* along the cable's length. The pictures on these pages show how adaptable and flexible such a wiring system can be.

Tiger Brand Armorlokt is made in a complete range of sizes and constructions. Ask your AS&W salesman.

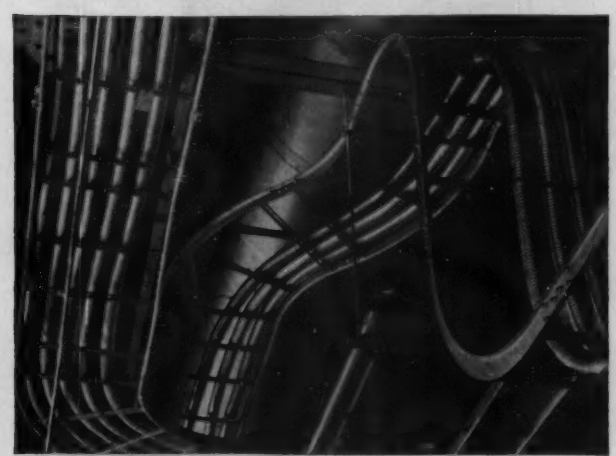
AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION
GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Winch on truck does the pulling. Crew members talk to each other with telephones.

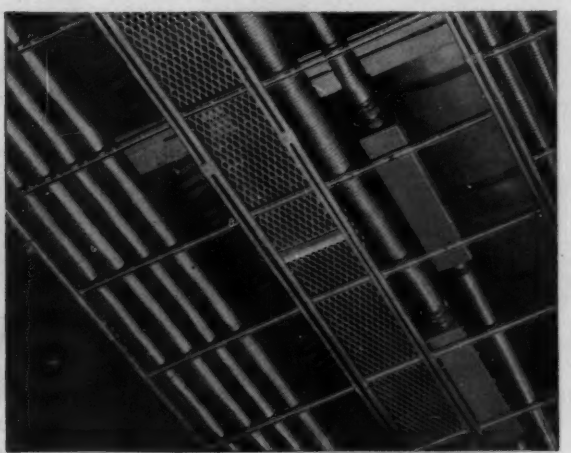
# of adequate wiring in 1977,
Armorlokt now!

Armorlokt terminates easily. Flexibility of the cable eliminates fussy joint work.

Small radius or large radius curves are easily handled. Space is left for future cable.



Imagine how this would look using old-style conduit. Now it's neat and accessible.



Splices can be made anywhere, an important feature if cable is damaged in service.

USS TIGER BRAND ELECTRICAL WIRE & CABLE

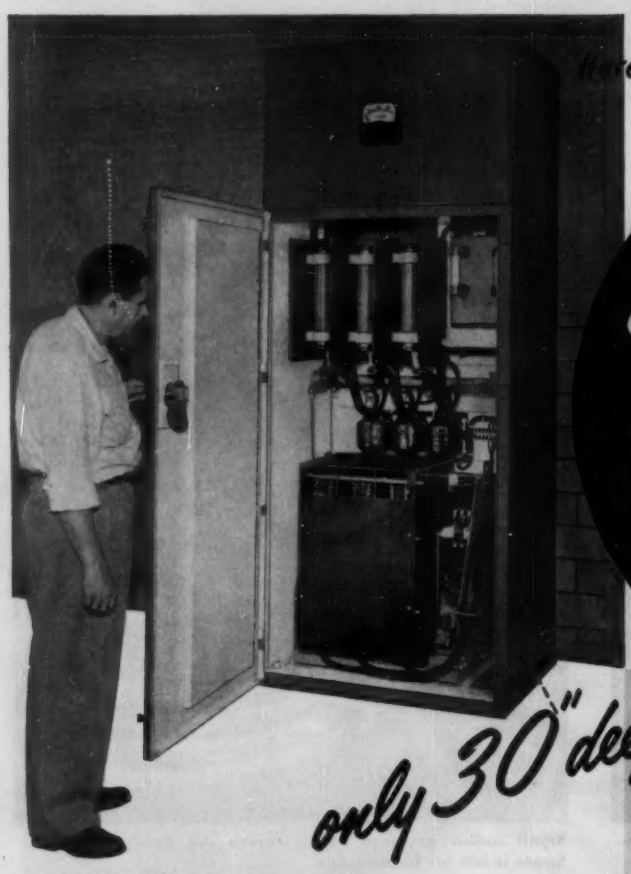
A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB

- ASBESTOS WIRE AND CABLE
- MOLD CURED PORTABLE CORD
- SHOVEL & DREDGE CABLE
- PAPER & LEAD CABLE
- VARNISHED CAMBRIC CABLE
- INTERLOCKED ARMOR CABLE
- SPECIAL PURPOSE WIRE & CABLE
- AERIAL, UNDERGROUND AND SUBMARINE CABLE

USS

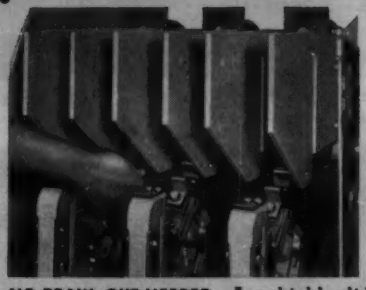
UNITED STATES STEEL

Here is **DESIGN LEADERSHIP...** *in Action!*



Save Space with New EC&M High Voltage (2200-4800 VOLTS) Starters

only 30" deep!



NO DRAW-OUT NEEDED • Arc shields slide out horizontally, making front and rear contact-tips removable with standard wrench.

Accessible from Front...

(Solid back) • Starters may be mounted against wall or in double row, back to back

Safe...

Starter DISCONNECTED from bus as door is opened
Low voltage section isolated from high voltage

Interlocked...

against accidental closure by simple rod mechanism
Large wiring space for incoming leads

EC&M's new ZHA Starter not only saves valuable floor space—it provides more accessibility and convenience than ever before. Starters are available with self-contained bus in isolated compartment. A gang of starters requires only one incoming feeder. Additional starters can be added as needed—with no sacrifice in neat, streamlined appearance. All starters are self-contained and complete with control transformer supplying low voltage for pushbutton circuits.

***Write for* BULLETIN 8130-F**

3 Interrupting Ratings for Squirrel Cage, Synchronous and Wound-rotor Motors

1. **CLASS E 1** • 50,000 KVA (symmetrical) based on certified tests.
2. **CLASS E 2** • With current limiting fuses and high interrupting capacity contactor. At 2300 volts: 150,000 KVA, 3 phase; 60,000 RMS amperes asymmetrical. At 4,800 volts: 250,000 KVA, 3 phase; 60,000 RMS amperes asymmetrical.
3. **VALIMITOR®** • May be used on a bus of unlimited short circuit capacity, through the use of a contactor with an interrupting rating of 50,000 KVA, and reactors which limit any fault current to a maximum of 25,000 KVA.

THE ELECTRIC CONTROLLER & MFG. CO.
A DIVISION OF THE SQUARE D COMPANY
CLEVELAND 28 • OHIO

7955

KELLOGG'S FIELD CONTROL KEEPS PACE

(Above) An inspector on Kellogg's permanent staff supervises welding of main steam lines at the Glen Lyn Station. (Below) Controls for the gang of 40-kva stress relieving units at Glen Lyn provide a permanent record of preheating, concurrent heating, and stress relieving cycles, ranging from room temperature to 1350 F.

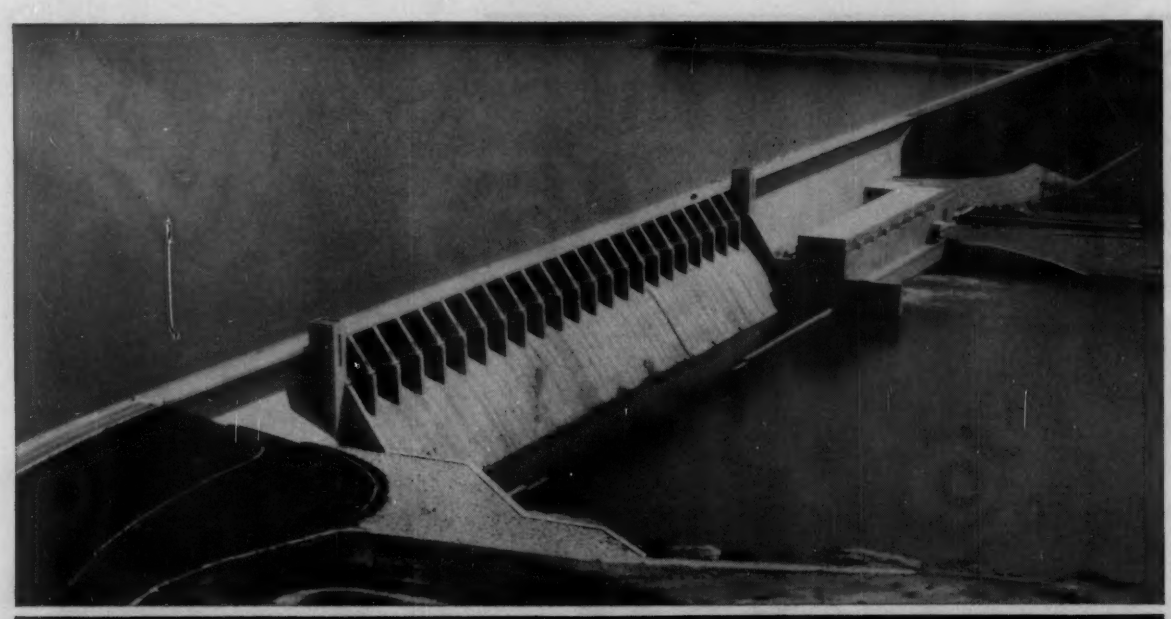
All high and low pressure steam piping for the 225,000-kw turbine-generator at Appalachian Electric Power Company's Glen Lyn, Virginia, station was fabricated and erected by M. W. Kellogg—using local union labor. Initial steam conditions are 1050 F, 2000 psi, with reheat at 1050 F. Main steam lines are 2¼% chrome-1% molybdenum, 12¾ in. OD, 2¼ in. average wall thickness. To meet the exacting requirements of both American Gas and Electric Service Corporation and The M. W. Kellogg Company, close control of techniques and procedures was doubly important.

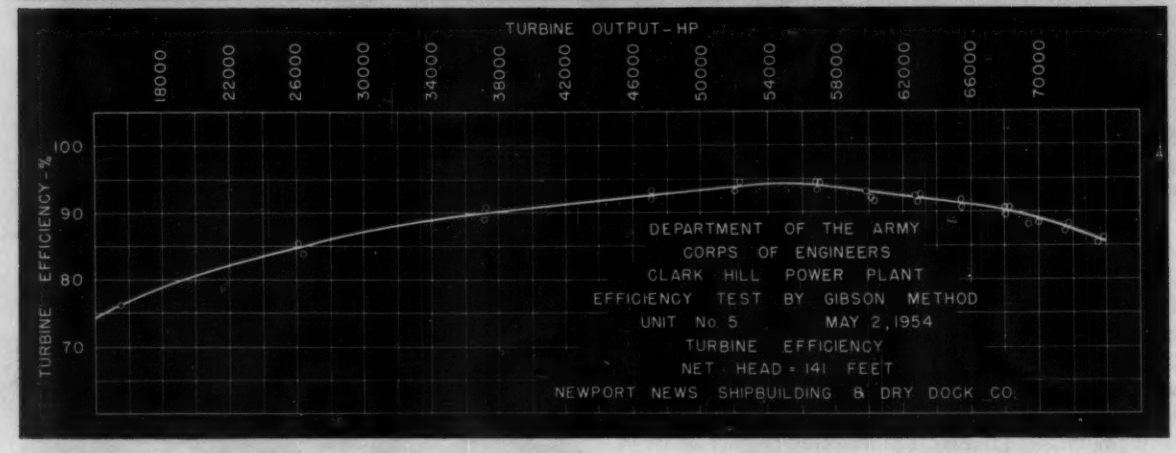
At Glen Lyn, as elsewhere in the field, M. W. Kellogg's reputation for completing a power piping project efficiently and promptly is due to the right techniques, the right materials, the right equipment, and—equally important—the right men to train and supervise labor to Kellogg's special standards. We welcome the opportunity to demonstrate these unique abilities and facilities. Some of them, including K-Weld*, are described in our 12-page booklet, "For The Modern Central Power Station." Write for your copy.

Fabricated Products Division
The M. W. Kellogg Company, 711 Third Avenue, New York 17, N. Y.
A SUBSIDIARY OF PULLMAN INCORPORATED
The Canadian Kellogg Company Ltd., Toronto • Kellogg International Corp., London
Kellogg Pan American Corp., New York • Societe Kellogg, Paris
Companhia Kellogg Brasileira, Rio de Janeiro • Compania Kellogg de Venezuela, Caracas

POWER PIPING—THE VITAL LINK

**Trademark of and patented by The M. W. Kellogg Company*





Maximum efficiency of 94.1%

Reflects advanced practices at Newport News

THE GRAPH shows performance of a 55,000 horsepower turbine, one of seven such units built by Newport News for the Clark Hill Power Plant (see photo).

Shape of the curve is typical . . . not exceptional . . . for Newport News turbine performance. Regular, uniform, showing no-cut-off at full load, it indicates consistent delivery and stable operation.

And especially, experience in design and model testing.

At Newport News, turbine runners are continually being designed and redesigned for improvements in performance. And often upon receiving a contract for turbines, a model setting is built and complete tests made. So far, Newport News has filled turbine contracts with an aggregate rated output in excess of 7,000,000 horsepower.

Penstocks, spiral casings, valves, pumps, rack rakes and other essentials are also designed and built by Newport News. Our illustrated booklet, "WATER POWER EQUIPMENT," will be sent to you upon request.

Engineers . . . Desirable positions available at Newport News for Designers and Engineers in many categories. Address inquiries to Employment Manager.

Newport News

Shipbuilding and Dry Dock Company
Newport News, Virginia

Linemen are enthusiastic!

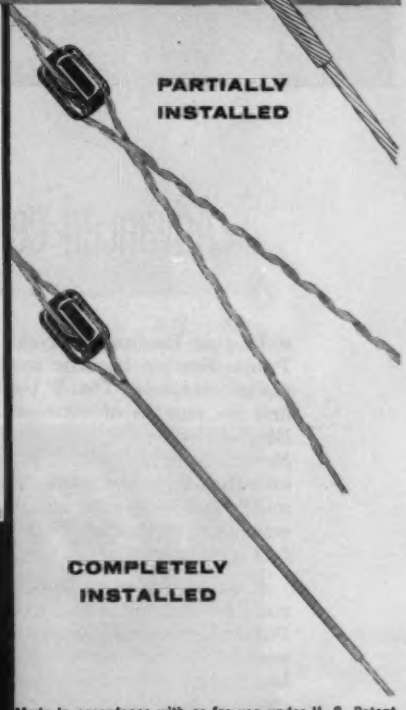
PLP GUY-GRIP dead-ends are the easiest, fastest and safest method yet devised for dead-ending strand.

Installation is easy because it takes just one unit, no moveable parts, no bolts or clamps to tighten. It's fast. All you do is hand-wrap the dead-end legs around the strand.

And it's safe. You can see at a glance that the installation is completed and thus secure. Linemen make better time, take pride in their work.
Dept. No. PR1C

PX-81

PREFORMED LINE PRODUCTS CO.
5349 ST. CLAIR AVE. • CLEVELAND 3, OHIO
TELEPHONE CLEVELAND 881-[illegible]



Made in accordance with or for use under U. S. Patent No. 2,761,273; other patents issued and pending.

Advanced central control uses L&N combustion system to

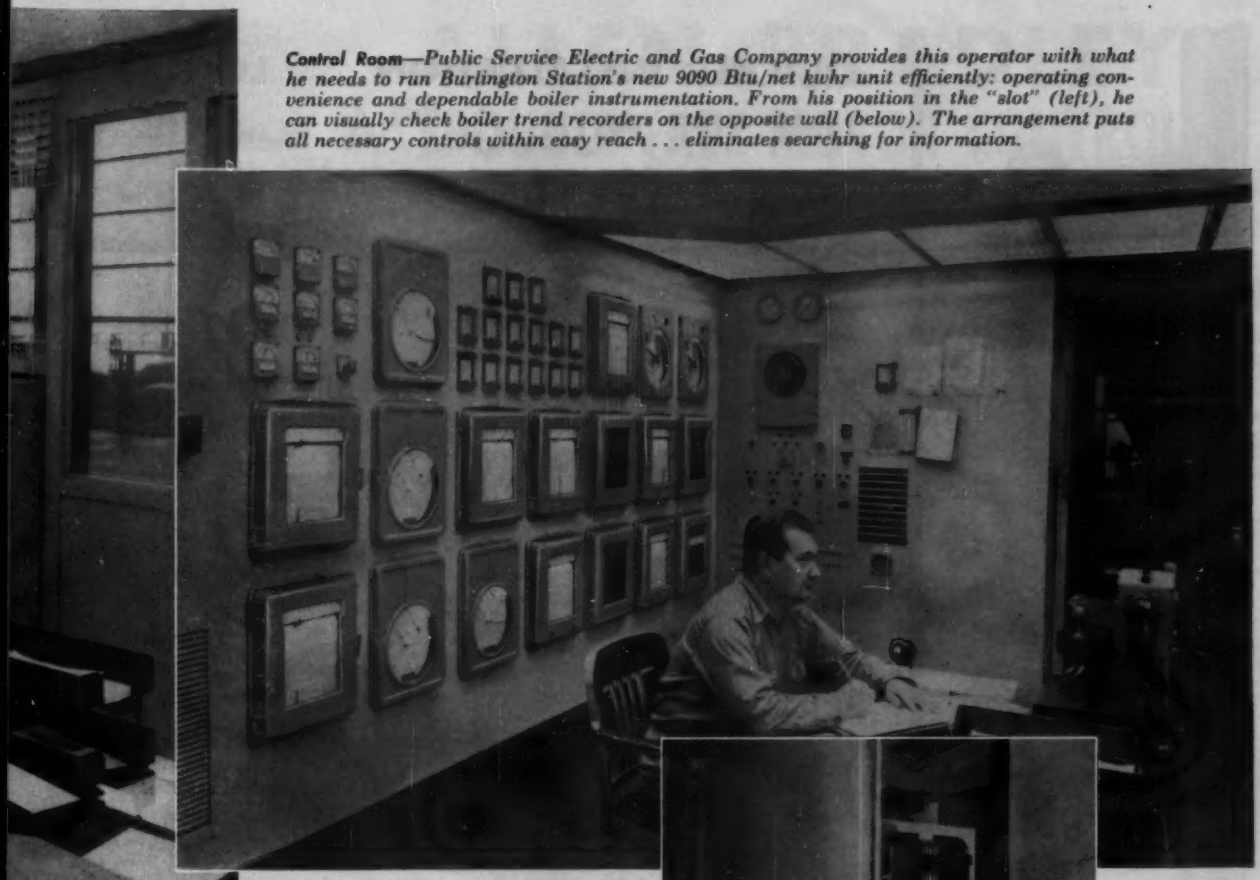
• In this Burlington, New Jersey plant of the Public Service Electric and Gas Company, the newly completed No. 7 Unit's heat rate for the first six months of commercial service was 9090 Btu/net kwhr, the best in the country. Number Seven's boiler capacity is 1,225,000 lb/hr, with turbine throttle steam pressure of 2350 psi, superheat and reheat temperatures of 1100 F and 1050 F, and generator output of 200,000 kilowatts. Furnace fuel is either coal or oil.

A quick glance at Burlington's central control room for this unit is all that's needed to realize that Public Service's advanced engineering techniques went into it. For example, the control room operator has control information brought to *him*. Due to the compact console arrangement he can perform his duties as conveniently and effectively as an airline pilot. There's no wasted space, time or effort.

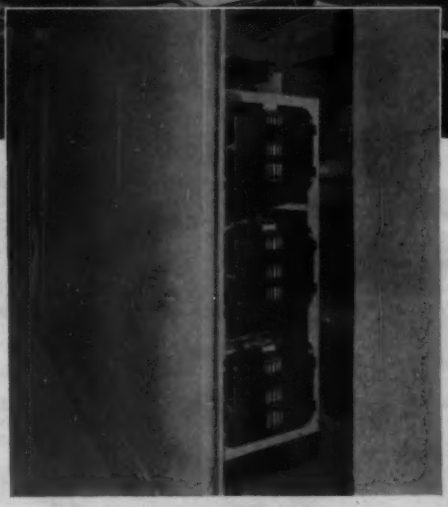
A desirable arrangement—but how is it accomplished without sacrificing reliability, accessibility or economy of components?

A major part of the answer is use of standard Leeds & Northrup *electric* control switches and position indicators. In addition, an auxiliary control cubicle houses the control auxiliaries . . . saves installation time and costs. Made at the L&N factory, it's delivered ready for operation, minimizing those inevitable last-minute installation problems.

Another "problem solver" is L&N combustion control which day after day provides precise steam pressure and excess air regulation—enables the new unit to perform at high efficiency. One reason is that this is a basically electric control—electric drive units introduce no transmission lags regardless of control room location . . . and *no* weather can freeze the electric transmission cables which



***Control Room**—Public Service Electric and Gas Company provides this operator with what he needs to run Burlington Station's new 9090 Btu/net kwhr unit efficiently: operating convenience and dependable boiler instrumentation. From his position in the "slot" (left), he can visually check boiler trend recorders on the opposite wall (below). The arrangement puts all necessary controls within easy reach . . . eliminates searching for information.*



***Cubicle**—To cut installation time and costs, an L&N Combustion Control cubicle (right) was installed as a factory-assembled unit. Automatic L&N Combustion Control eliminates long tubing runs to central control room.*

guide unit with best heat rate

connect to Burlington's outdoor electric L&N drive units.

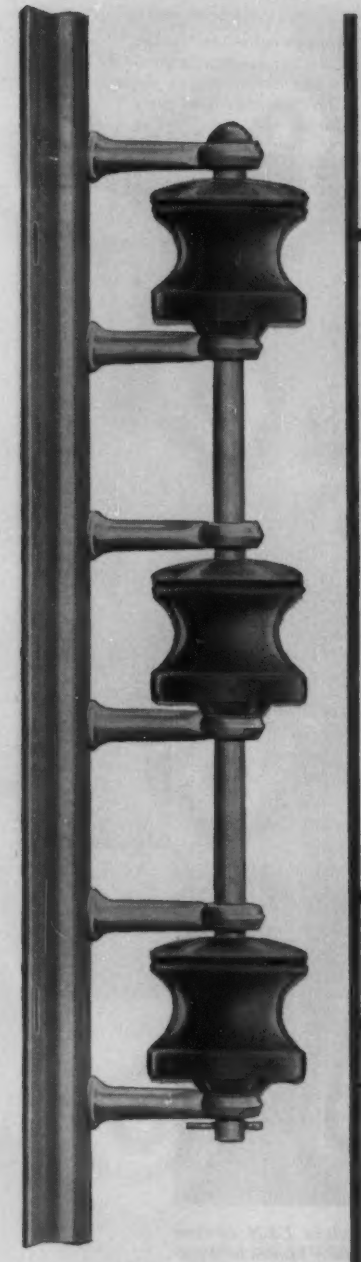
As you would expect, the new unit was placed on automatic control well within the first week's continuous operation of the unit. Significantly, the complete combustion and steam temperature control, as well as flue gas oxygen measurement for the new Public Service Linden Generating Station, is L&N.

We'd like to suggest that if you're looking toward a new unit which calls for integrated controls, you look to Leeds & Northrup Company, 4938 Stenton Avenue, Philadelphia 44, Pa.

LEEDS NORTHRUP
Instruments Automatic Controls • Furnaces

***Drive Unit**—With rugged outdoor L&N electric drive units (below), the operator knows he's getting efficient operation. No matter what the weather, these units are free of transmission lags . . . give positive control action.*

Jrl. Ad NUS-01-463(9)



QUICKER INSTALLATION . . . LONGER LINE LIFE WITH OEM FORGED-POINT SECONDARY RACKS

Torturous stresses, day after day and year after year, can't distort an OEM forged-point secondary rack!

FOR HOLDING STRENGTH and uniform load distribution, the forged, smooth-contour points are hot upset to the back.

FOR INSTALLATION SPEED AND CONVENIENCE, there's the curved-back design, providing solid, broad contact between rack and pole, and, at the same time, clearance for ⅝" nuts.

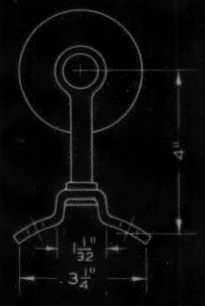
FOR PROTECTION of your power line and insulators, there's perfect, straight-through bolt-and-point alignment; round, forged points which eliminate any edges that might cause insulation damage—AND no pockets in which water can accumulate!

FOR LONG SERVICE, there's the extra-heavy galvanized coating . . . the heaviest possible. Entire unit meets, or exceeds, E.E.I. specifications.

These racks are typical of the complete line of high-quality pole line materials which are quantity-stocked and speedily shipped to fill every order. The brand-new combination which resulted from merging Oliver with Electrical Manufacturing Company, is ready to quickly fill ALL your pole line hardware needs!

WRITE FOR FURTHER INFORMATION AND/OR ORDER BY CATALOG NUMBERS SHOWN IN CHART BELOW.

SERIES	GAUGE	BACK	INSULATOR SIZE
2000	9	Extended	3"
2100	9	Non-Extended	3"
8300	12	Extended	3"
8400	12	Non-Extended	3"
7800	12	Extended	2⅛"



End view showing clearance for ⅝" hex nut.

OEM'S first Dallas warehouse was established in November, 1950. Just 6 years later it was necessary to double the floor space of the old warehouse, to keep pace with its increasing volume of business in the Southwest Region. Shown here is the new Dallas warehouse opened January 15, 1957 and managed by Southern Sales Manager C. R. Dudley. The new Dallas warehouse is located along railroad sidings in the Dallas Trinity Industrial District and will serve an area including Texas, New Mexico, Oklahoma and western Louisiana. The large stock of OEM products stored here is typical of OEM's continuing expansion program—a program designed to serve you better with a complete line of quality pole line hardware.

63

OEM OLIVER ELECTRICAL MANUFACTURING COMPANY

BOX 217, BATTLE CREEK, MICHIGAN

Factories in Pittsburgh and Battle Creek • Warehouses in Battle Creek, Boston, Birmingham, Chicago, Dallas, Pittsburgh and St. Paul.

The Sign of **QUALITY** MOTOR CONTROL

ALLEN-BRADLEY
TROUBLE FREE MOTOR CONTROL

Here are the 3 most popular Allen-Bradley starters. They are QUALITY products widely associated with QUALITY machines. Electricians and maintenance men appreciate the trouble free operation of A-B motor controls. Send for your copy of the A-B Handy Catalog.

BULLETIN 609 MANUAL ACROSS-THE-LINE STARTERS UP TO 5 HP, 220 V; 7½ HP, 440-550 VOLTS

A Kindt-Collins Master profile grinder equipped with an A-B Bulletin 609 manual starter and an A-B Bulletin 807 drum switch.

Allen-Bradley drum switches come in many styles and ratings. Send for bulletin.

Bulletin 609 arc hood lifted to show the contacts.

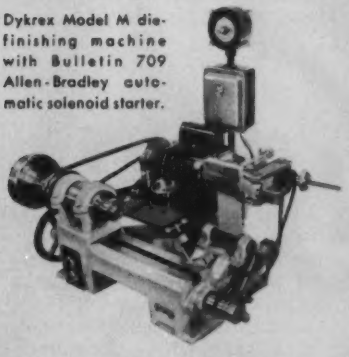
These Bulletin 609 manual starters are popularly used on motorized machines where no safety hazard to workmen is created if the machines should start unexpectedly, after a power interruption.

The quick-make, quick-break switch has double break, silver alloy contacts which require no maintenance.

Two thermal breakers give dependable overload protection, no matter how long in service. They are reset by pressing the RESET button.

BULLETIN 709 AUTOMATIC ACROSS-THE-LINE STARTERS UP TO 300 HP, 220 V; 600 HP, 440-550 VOLTS

Dykrex Model M die-finishing machine with Bulletin 709 Allen-Bradley automatic solenoid starter.



Bulletin 709 starters available in 8 sizes. Sizes 0, 1, and 2 shown below.

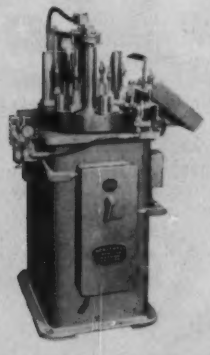
Quality appearance and reputation for reliability make Bulletin 709 starters an asset to any machine.

Bulletin 709 solenoid starters provide the safety feature of no-voltage protection. If the motor is stopped, due to power line interruption, it cannot restart until the operator presses the Start button.

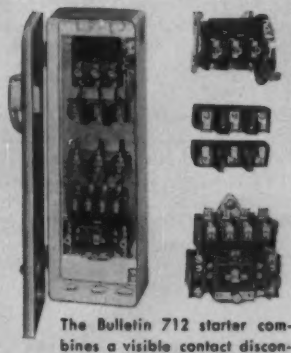
All Bulletin 709 starters have silver alloy, double break contacts that need no filing, cleaning, or dressing. They are good for millions of trouble free operations.

Two overload relays protect the motor against burnouts.

BULLETIN 712-713 COMBINATION AUTOMATIC STARTERS UP TO 100 HP, 220 V; 200 HP, 440-550 VOLTS



Noble & Westbrook Roll-O-Mark marking machine equipped with A-B Bulletin 712 combination starter. Makes a neat & compact installation.



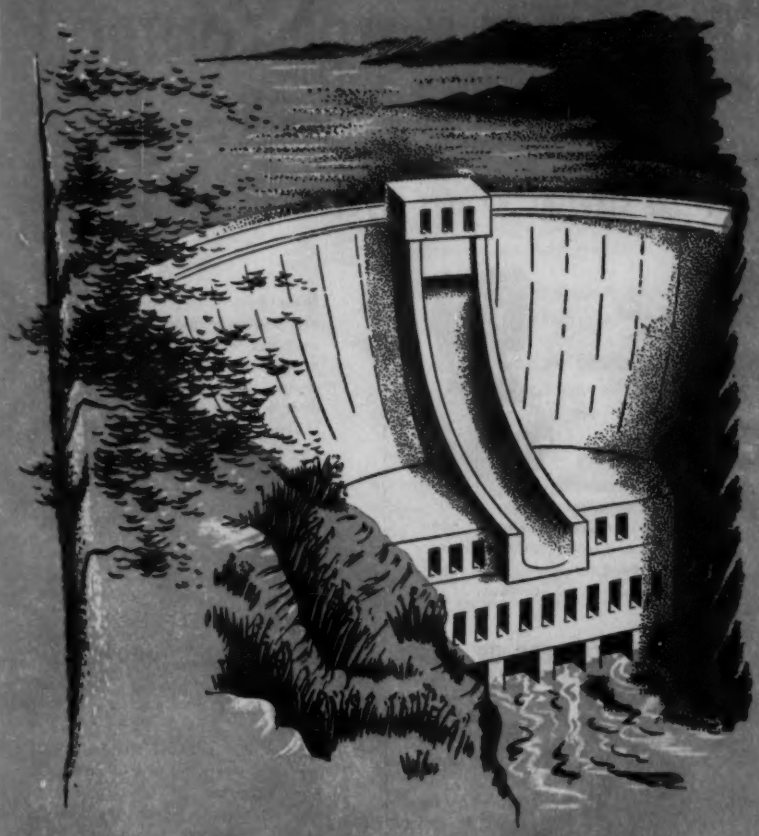
The Bulletin 712 starter combines a visible contact disconnect and a Bulletin 709 starter.

Bulletin 713 combination starters combine, in one enclosure, an I-T-E instantaneous circuit breaker and a Bulletin 709 starter.

Thermal overload relays are standard equipment on all Bulletin 712-713 combination starters.

Bulletin 712-713 starters provide the additional protection that the cabinet cannot be opened unless the disconnect lever is OFF; the starter is then "dead."

Allen-Bradley Co., 1327 S. First St., Milwaukee 4, Wis. • In Canada—Allen-Bradley Canada Ltd., Galt, Ont.



FERRANTI

Transformers for Hydro-Electric Schemes

As specialists in the manufacture of transformers for more than 65 years, FERRANTI LTD. have been associated with many of the world's largest hydro-electric schemes.

More recent achievements include contracts for over 4,000,000 kVA of large high voltage power transformers, among which are :-

CENTRAL AFRICA

Two 120,000 kVA and six 60,000 kVA 330,000 volts three-phase Transformers have been ordered by the Central African Federation Power Board for the Kariba Hydro-Electric Scheme. This is the largest overseas transformer contract ever to be placed in the United Kingdom.

CANADA

Seven 71,000 kVA, 301,400 volt single-phase Ferranti generator transformers and six 37,000 kVA, 275,000 volt step-down Ferranti transformers have been ordered by the Aluminum Company of Canada Ltd. for the Alcan Project at Kemano and Kitimat, British Columbia. Four of the generator transformers and all of the supply transformers are now in commission.

U.S.A.

GARRISON DAM PROJECT Nine 33,333 kVA, 230,000 volt single-phase Ferranti transformers forming three 100,000 kVA banks have been supplied to the U.S. Army Corps of Engineers for the Garrison Dam Project, North Dakota.

McNARY DAM PROJECT Six 56,000 kVA, 230,000 volt, single-phase transformers have been ordered by the U.S. Army Corps of Engineers for the McNary Dam Project, Oregon.

DALLES DAM PROJECT The contract covers eighteen 63,000 kVA, 230 kV and three 63,000 kVA, 115 kV, single-phase transformers for the U.S. Army Corps of Engineers Dalles Dam Project, Columbia River.

NEW ZEALAND

Twenty-six Ferranti large power transformers have been ordered by the State Hydro-Electric Department of New Zealand. Thirteen 14,800 kVA, single-phase, 50 cycles, 11/220 kV transformers have already been supplied to Roxburgh. Thirteen 9,259 kVA, single-phase, 50 cycles, 11/220 kV transformers for Whakamaru are under construction.

INDIA

Three Ferranti 20,000 kVA, OFB, 3-phase, 50 cycles, 132/33·66 kV transformers with on-load tap changing gear and two Ferranti 10,000 kVA, ON/OB, 3-phase, 50 cycles, 132/33 kV transformers with on-load tap changing gear have been supplied for the Damodar Valley Power Scheme in India.

FERRANTI LTD · HOLLINWOOD · LANCS

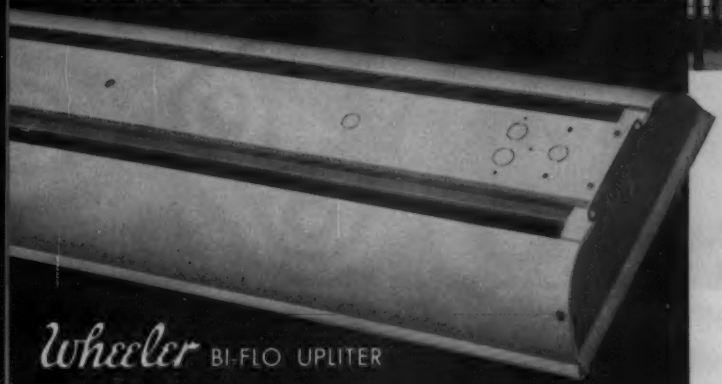
London Office: KERN HOUSE, 36 KINGSWAY, W.C.2.

Wheeler

"PACKAGE PLAN" LIGHTING

the efficient, time-saving way to solve <u>all</u> your lighting requirements <u>at one time!</u>

Fluorescent — Incandescent — Specialized Lighting . . . most jobs require not just one but various combinations of these modern forms of industrial lighting. When you submit your requirements to Wheeler Reflector Company, one quote does it. No need to split your requirements or to locate sources for each type. One quote! One source! One standard of quality for over 75 years!



Wheeler "PACKAGE PLAN" Lighting as installed in plant of Tracerlab inc. Pioneer in the Nuclear Industry

Wheeler Reflector Company

DIVISION OF FRANKLIN RESEARCH CORP.

275 Congress Street, Boston 10, Mass.

Distributed Exclusively through Electrical Wholesalers

Inside story of the grids that made the giant

NOW AT RATINGS DOWN TO 69 KV

The Westinghouse tubular, multi-break interrupter, only two years ago, made possible the world's first 330-kv, 25-million-kva circuit breaker.

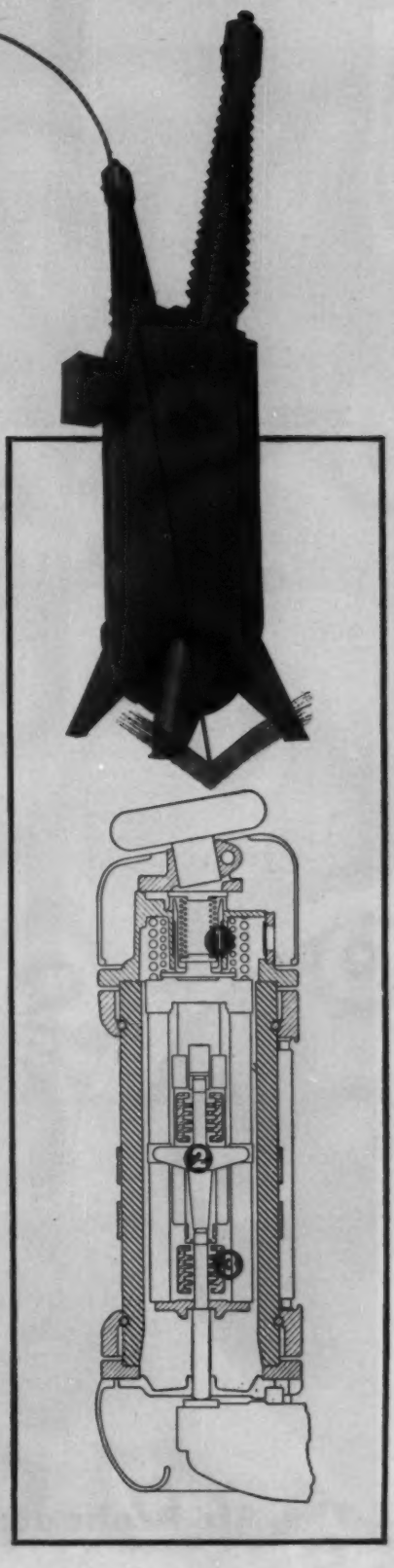
Now, this same tubular interrupter is applied to breaker ratings of 69 kv (3½ million and 5 million kva), 138 kv (10 million kva), 161 kv (15 million kva) and 230 kv (15 million kva).

Another big plus is the extremely simple inspection and maintenance procedure. Interrupter blocks—two to eight per pole—may be removed by loosening only a few MICARTA® bolts. With the blocks removed, both the stationary fingers and the moving contacts are visible. They can be replaced, if necessary, with the tubular shell still mounted on the bushing—without loss of contact alignment. Interrupter blocks are identical in all ratings from 69 kv through 330 kv. Contacts and fingers for ratings above 138 kv are also interchangeable. Spare parts inventory is reduced to a minimum.

Tubular multi-break grids provide excellent line-dropping and capacitor-switching characteristics—proved in laboratory and field tests. The integral oil-driving piston assures fast extinction of low-current arcs. Grids are simple to install—and in some instances can be added to existing breakers. All the details are available from your Westinghouse sales representative—or you may write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa., for descriptive literature. J-60912

YOU CAN BE SURE...IF IT'S

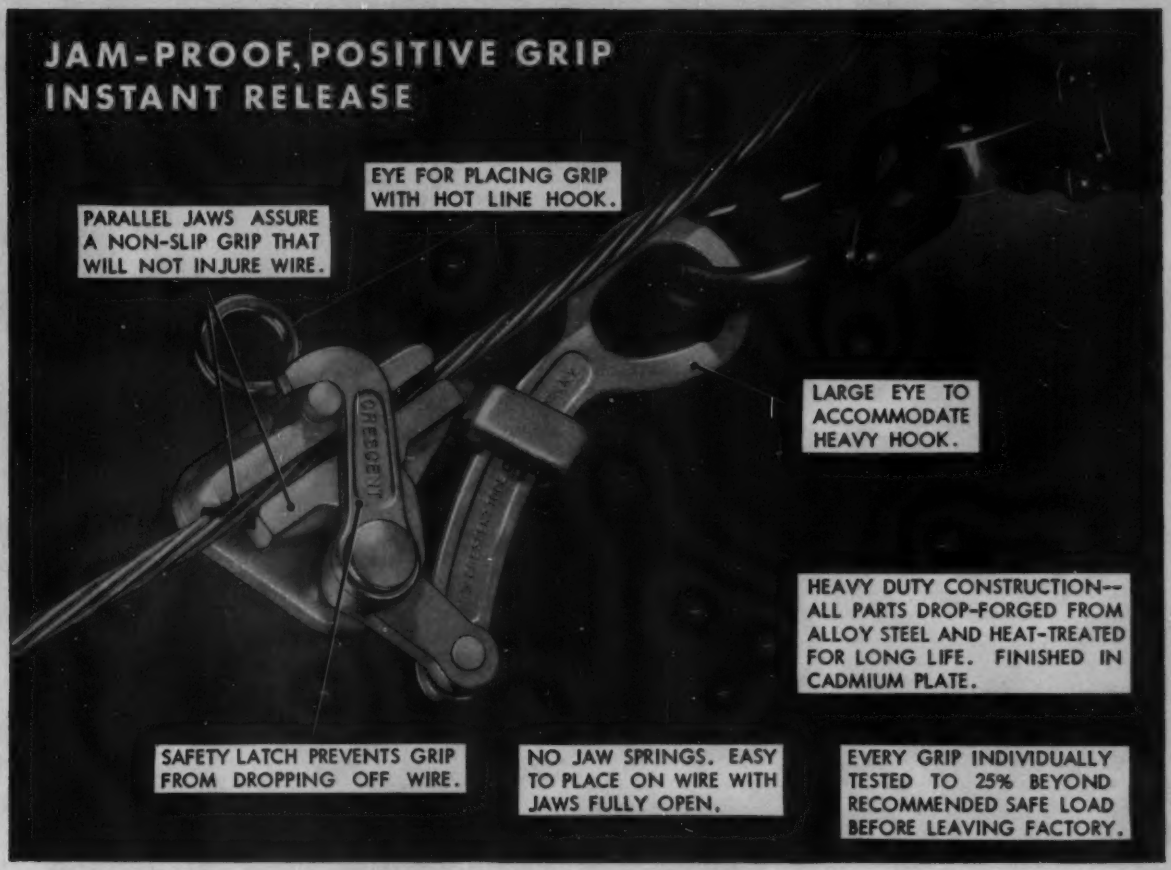
Westinghouse



Sectional view at left shows interrupter top casting assembly with ① oil driving pump, ② contact assemblies, ③ fibre interrupter blocks and other essential design features.

WHAT'S
SPECIAL
ABOUT
LJUNGSTROM®
research and engineering
Air Preheater has made many important advances in gas-to-gas heat exchangers over the past 32 years. Some of the major developments of Air Preheater research are:
• The mass flow soot blower
• Multiple-layer heating surface
• Wide-spaced cold end heating surface
• Methods of cold end protection
• Use of alloy steel for cold end material
• Designs of more compact and effective heating surfaces
• Heat transfer surfaces replaceable during boiler operation
• Superheated steam for soot blowing
That's why seven out of ten air preheater installations are Ljungstrom. For the full story of its many advantages, write now for your copy of our 38-page manual.
The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

CRESCENT WIRE GRIPS


JAM-PROOF, POSITIVE GRIP
INSTANT RELEASE
EYE FOR PLACING GRIP WITH HOT LINE HOOK.
PARALLEL JAWS ASSURE A NON-SLIP GRIP THAT WILL NOT INJURE WIRE.
LARGE EYE TO ACCOMMODATE HEAVY HOOK.
HEAVY DUTY CONSTRUCTION-- ALL PARTS DROP-FORGED FROM ALLOY STEEL AND HEAT-TREATED FOR LONG LIFE. FINISHED IN CADMIUM PLATE.
SAFETY LATCH PREVENTS GRIP FROM DROPPING OFF WIRE.
NO JAW SPRINGS. EASY TO PLACE ON WIRE WITH JAWS FULLY OPEN.
EVERY GRIP INDIVIDUALLY TESTED TO 25% BEYOND RECOMMENDED SAFE LOAD BEFORE LEAVING FACTORY.

SPECIFICATIONS

Number	*Maximum Capacity*	*Minimum Capacity*	*Safe Load*	*Eye Opening*	*Weight*
383 —Serrated Jaws	5/16 (.3125)" 8 mm.	—5/32 (.156)" 4 mm.	5,000 lbs. (2200 KG)	1-1/8" x 1-11/16"	1-3/4 lbs.
383-2—Same, except with smooth jaws for aluminum wire.					
384 —Serrated Jaws	1/2 (.500)" 12.2 mm.	—1/4 (.250)" 6.5 mm.	7,500 lbs. (3400 KG)	1-1/4" x 1-3/4"	3-5/16 lbs.
384-2—Same, except with smooth jaws for aluminum wire.					
385 —Serrated Jaws	3/4 (.750)" 19 mm.	—3/8 (.375)" 9.5 mm.	10,000 lbs. (4500 KG)	1-1/4" x 1-3/4"	4-7/8 lbs.
385-2—Same, except with smooth jaws for aluminum wire.					
386 —Serrated Jaws	1-1/16 (1.0625)" 27 mm.	—9/16 (.5625)" 14.5 mm.	12,500 lbs. (5600 KG)	1-5/8" x 2-3/8"	9 lbs.
386-2—Same, except with smooth jaws for aluminum wire.					

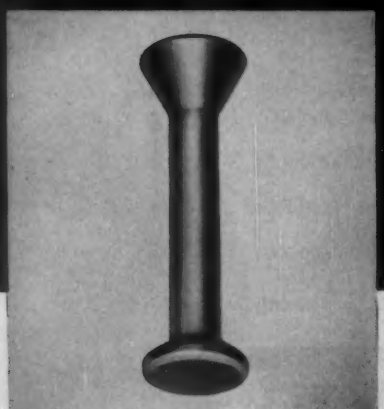
For bare and insulated wire, use serrated jaw style. For bare aluminum wire only, smooth jaws.

Write for Crescent Catalog No. 28 which illustrates and describes many valuable tools for linemen and other electrical workers.

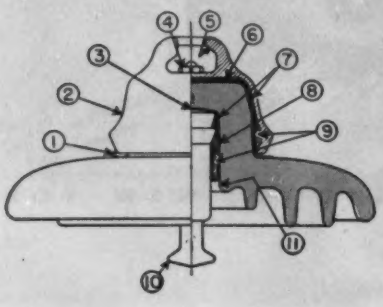
Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

Triple-Tested...



Stainless steel pin, for use in high-contamination or coastal areas. Available in all suspension insulators on special order.



One of Illinois' outstanding porcelain products is this 10-inch suspension insulator. The cutaway view shows some of the features that assure quality.

1. Ample clearance between edge of cap and top of porcelain shield.

2. High-grade malleable cap, treated to prevent embrittlement when galvanized. Forged steel cap also available. Galvanizing is closely controlled in our own plant.

3. Treated fibrous washer provides a cushion between end of pin and porcelain.

4. Spring brass cotter key.

5. Smooth socket, accurately manufactured to standard dimensions.

6. Resilient compound provides cushion between bottom of cap and top of porcelain.

7. Resilient compound applied on inside of cap and outside of pin.

8. Sanded surfaces (controlled particle size).

9. Cemented joint between hardware and porcelain is neat portland cement.

10. Forged steel pin, accurately gauged to standard dimensions. Also available in stainless steel for use in high-contamination or coastal areas.

11. Radio glaze treatment available if desired, though these insulators meet satisfactory radio noise-level requirements without treatment.

Illinois Electric Porcelain... Triple-Tested To Insure Extra Mechanical And Electrical Strength

1 Complete laboratory control of materials.

2 Extensive new quality-control system.

3 Rigid final testing.

All combine to insure extremely high quality in the finished porcelain insulators.

by **W. V. SWAN**, Vice President
Illinois Electric Porcelain Company

In the two years that Illinois Electric Porcelain has been under Line Material Company operation, we have made extensive changes, from one end of the plant to the other.

A completely new ceramic laboratory has been built, containing the latest equipment for testing raw materials and production methods, and for developing new tests to assure customers that they will get insulators of extremely high quality.

Accurately Controlled Production

The latest precision production machinery has been installed. New, accurately controlled molding, pressing, drying, glazing, and firing equipment assure much more uniform production, and porcelain of greater uniformity in density and strength.

Our facilities include our own completely new, modern galvanizing plant for insulator hardware and fittings. This assures accurate quality control under our own supervision.

Amply Meet EEI-NEMA Standards

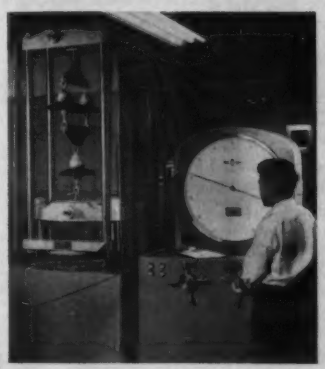
The result is that, today, porcelain insulators shipped from this plant are among the highest quality available in the industry. You can buy them with full assurance that you are getting porcelain insulators second to none. They meet EEI-NEMA standards with an ample margin of safety.

Get Complete Information

Illinois Electric Porcelain Company products include porcelain insulators, hardware, and fittings. These products are sold through Line Material Company. Ask the L-M Field Engineer for complete information, and a copy of the informative Bulletin DL8; or write Line Material Industries, Milwaukee 1, Wisconsin (McGraw-Edison Company)

Here's one of the newest developments at Illinois Electric. On this huge wheel, spool and pin type insulators and wireholders are automatically glazed on all sides and partly dried by warm-air circulation, insuring uniform, complete glazing.

Two huge automatic dryers gradually dry the formed porcelain. Heat and humidity are automatically controlled as the ware slowly passes through the dryers. This provides strong, dense ware, free from internal stresses.



Suspension insulators are subjected to simultaneous mechanical and electrical test to destruction—a test performed on a representative quantity of insulators to insure high quality.

A corner of Illinois' complete new ceramic laboratory. The laboratory contains the latest equipment for analyzing materials and testing production processes.

ILLINOIS ELECTRIC PORCELAIN COMPANY

(a McGraw-Edison Company Subsidiary) • Macomb, Illinois

Distributed by **LINE MATERIAL** *Electrical Porcelain Insulators*

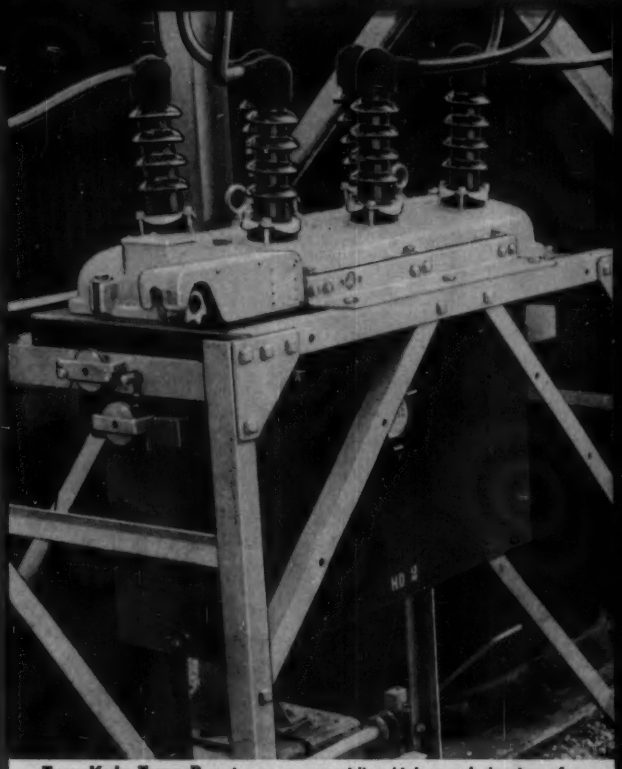
McGRAW-EDISON COMPANY

222-R

Analysis of Savings
Using Kyle Reclosers for Five Years*

	Savings on 100 Substations	
I. Initial Investment Costs		
A. At substation. A Type R OCR as compared with an equivalent OCB with AC tripping and reclosing.		
1. Initial savings in equipment costs favoring each OCR—$3227.00. Total savings for 100 substations for 5 years— 2 x 5 x 100 x $3227/20.....	$161,350.	
2. Initial savings in labor costs to install transformers and wiring necessary to operate OCB—$30 per OCR. Total savings for 100 substations for 5 years— 2 x 5 x 100 x $30/20.....	1,500.	
Total initial investment savings with OCR's		$162,850.
B. On distribution feeders with 5 sectionalizing points per feeder.		
1. Equipment costs of 3 OCR's and 2 sectionalizers exceeding that of 5 fused cutouts = $491. Additional costs to utilize self-protective scheme for 200 feeders for 5 years = 5 x 200 x $491/20.....(—)	$ 24,550.	
2. Labor costs of installations. OCR exceeding that of fused cutout = $15. Additional cost to utilize self-protective scheme for 200 feeders for 5 years = 5 x 200 x $15/20.....(—)	750.	
Total additional costs of OCR's and sectionalizers over fused cutouts.....		— 25,300.
C. Net savings in initial costs with OCR's....		$137,550.
II. Operating Costs (estimated 9 outages per feeder through transient conditions annually)		
A. Savings in frequency and duration of service trips resulting from transient faults 40 man-hours @ $5/hr. per feeder. $200. 25 truck hours @ $1/hr. per feeder 25. Cost of fuse links per feeder..... 5. Total cost of transient outages per feeder..... $230. Total 5-year cost for 100 substations = 5 x 2 x 100 x $230.....	$230,000.	
B. Increased revenue resulting from reduced outages. 1500 KWH per outages per feeder for 5 years through loss of service @ 2¢ per KWH = 1500 x 2 x 100 x 5 x $.02.....	30,000.	
C. Total savings from transient fault protection for 5-year period.....		$260,000.
III. Maintenance Costs		
A. OCR and sectionalizer maintenance cost @ $25 per unit annually = $25 x 5 x 2 x 100 x 5.....(—)	$125,000.	
B. OCB additional relay calibration costs @ $25 per unit annually = $25 x 2 x 100 x 5.....	25,000.	
C. Total additional costs of OCR and sectionalizer maintenance for 5 years.....		— $100,000.
IV. Carrying charges (conservatively estimated as 10% annually of initial capitalized investment)		
A. At substation. Savings represented by OCR's = ($3227 + $30) x 2 x 100 x 5 x .10.....	$325,700.	
B. On line, additional cost of automatic scheme = ($15 + $491) x 2 x 100 x 5 x .10....(—)	50,600.	
C. Savings in carrying charges with OCR's and sectionalizers.....		$275,100.
V. Subtotal.....		$572,650.
Additional savings resulting from Transient Fault protection		
VI. Savings realized by elimination of conductor and equipment damage through extra-fast clearing on heavy faults.....		$?
VII. Value of improved public relations realized through better continuity of service.....		$?
VIII. TOTAL SAVINGS.....		**Well over half a million dollars!**

**Costs are conservative estimates based on the best available information from utilities. System used to illustrate average installation consisted of 100 substations each with two 15 kv feeders, and amortized in 20 years.*



Two Kyle Type R reclosers are providing high-speed clearing of 13.8 kv feeders for transient fault protection and automatic disconnecting of permanent faults with minimum substation investment.

How Heavy-Duty Substation

The application of Kyle reclosers as the automatic disconnecting device in substations eliminates the relatively high costs of circuit breakers and associated substation equipments. This alone offers savings of a half million dollars or more in five years, based on 200 feeder positions.

Lower Initial Costs

Initial investment in Type R recloser equipment of equivalent rating will result in approximately $3,000 savings per feeder. In addition, field reports indicate that labor for installing Type R reclosers is about 50% of that for circuit breakers. The maintenance cost for reclosers is also lower than for circuit breakers.

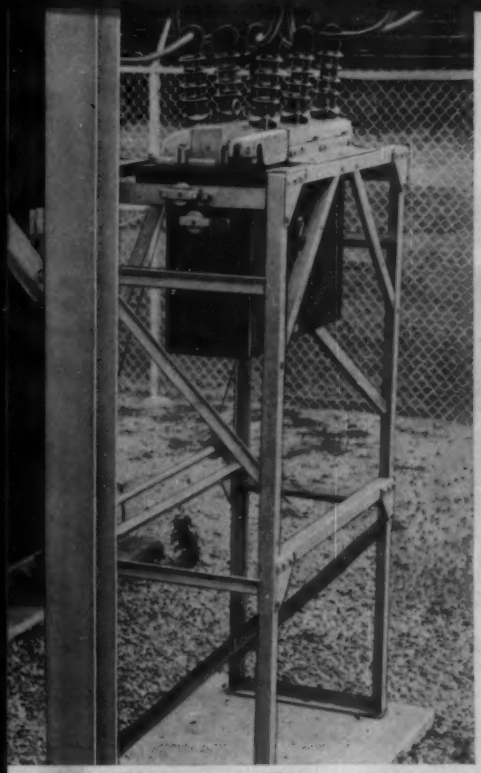
Fewer Outages

L-M Kyle reclosers can also be justified as a fault-protective device that will reduce the number of outages caused by transient or non-persistent causes. Kyle reclosers have extremely fast opening characteristics, clearing circuit in less than 2 cycles, which minimizes conductor burndown and increases service continuity.

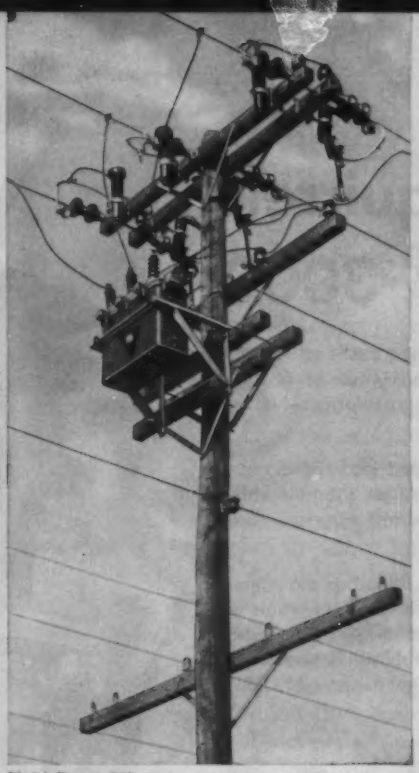
Compare the figures at the left with your construction and operating costs and see how you can save over a half million dollars with Kyle reclosers.

LINE MATERIAL

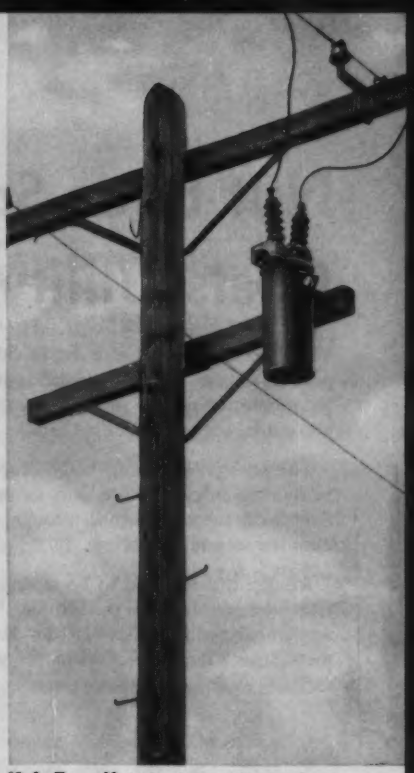
McGRAW-EDISON COMPANY



It is possible to clear over 90 percent of total circuit faults and reduce permanent faults with high-speed Kyle reclosers.



Kyle Type 3H 3-phase reclosers provide coordinated protection on rural lines with up to 1250 amperes at 14.4 kv. Where faults persist, recloser locks open on all 3 phases and confines trouble to a small area.



Kyle Type H single-phase recloser reduces the number of outages on rural lines caused by conductors whipping together on long spans, small branches grounding a conductor, or a lightning discharge.

Kyle Reclosers Reduce Investment And System Operating Costs

L-M high-speed reclosers provide better service continuity and lower operating costs by reducing conductor burndown caused by transient or non-persistent faults on the system. It is possible to clear over 90 percent of total circuit faults and reduce permanent faults with high-speed Kyle reclosers. Such faults are often caused by lightning, arrester flashover, tree limbs shorting the conductors, or conductors whipping together on long spans.

Eliminate the Shaded Area

The shaded area in the chart at right represents the additional fault-clearing ability of L-M high-speed Kyle reclosers. Kyle reclosers clear transient or non-persistent faults on the circuit with no significant damage to the system or interruption of service.

All Kyle reclosers can be coordinated in series to provide complete transient protection over entire distribution system.

Get Complete Information

Ask the L-M Field Engineer for more information on how Kyle reclosers can be profitably applied to your system. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

252-B

Kyle® Reclosers

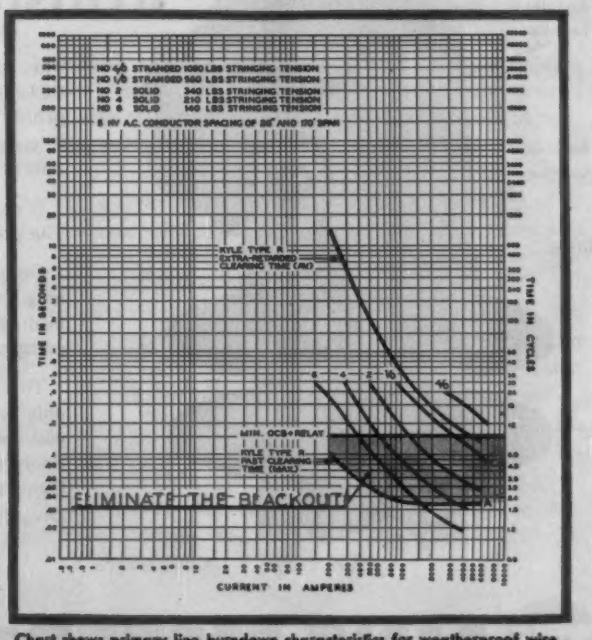
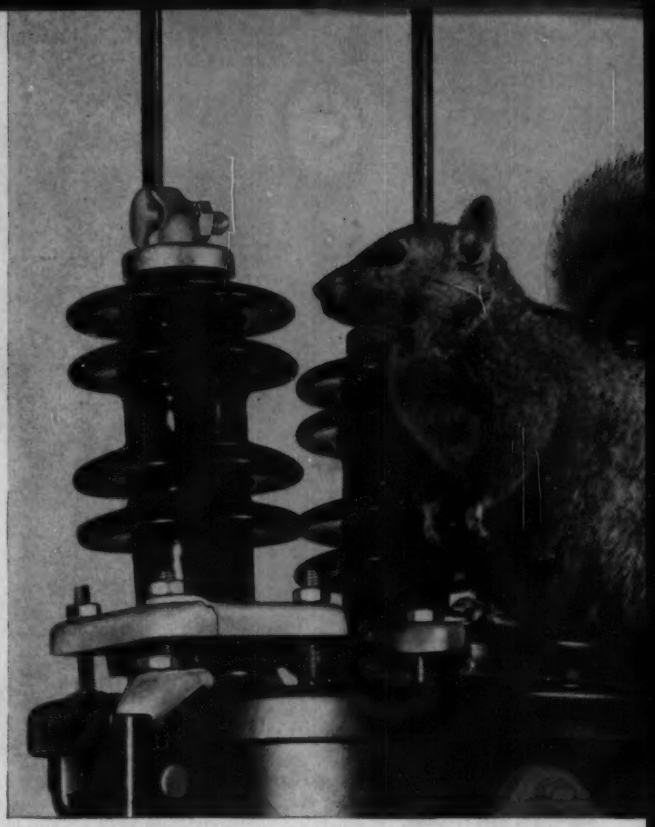

NO 4/0 STRANDED 1080 LBS STRINGING TENSION
NO 1/0 STRANDED 560 LBS STRINGING TENSION
NO 2 SOLID 340 LBS STRINGING TENSION
NO 4 SOLID 210 LBS STRINGING TENSION
NO 6 SOLID 140 LBS STRINGING TENSION
14.4 KV A.C. CONDUCTOR SPACING OF 36" AND 120" SPAN
KYLE TYPE R
EXTRA-DELAYED
CLEARING TIME (MAX)
MIN. OCB+RELAY
KYLE TYPE R
FAST CLEARING
TIME (MAX.)
ELIMINATE THE BLACKOUT
TIME IN SECONDS
TIME IN CYCLES
CURRENT IN AMPERES

Chart shows primary line burndown characteristics for weatherproof wire. It also gives the maximum clearing time for high-speed Kyle reclosers and minimum clearing time for the average circuit breaker plus relay time. The shaded area represents the additional protection that can be obtained with Kyle reclosers in place of circuit breakers.

Nut Bites Squirrel... Costs Utility $3000



You'll never believe it—we didn't either, but it actually happened! A curious squirrel evidently took a bite of the nut on the connector on top of a 7620-volt transformer—with the inevitable result. The nut bit back!

The squirrel's flaming body dropped into the dry grass below, which caught fire and in turn set the pole ablaze. Eventually the pole burned through, dropping primary wires onto the secondaries below.

Result: the pole had to be replaced—and so did some 30 television picture tubes in customers' homes. The whole deal was embarrassing and costly to the utility company—and to the squirrel's family also, which probably still has never satisfactorily explained to the neighbors what happened to Pappy.

It Can't Happen Here... on L-M's New Bite-Proof Transformer Bushing

This new bushing is designed to take the tap vertically, conforming to EEI-NEMA standards. Not only does it have a hand-tightening knob (which can't be spun off—but can be intentionally removed) but also it has a phenolic cap which covers the terminals completely. No hot nuts or other live parts are accessible.

If you use bare wire jumpers, we suggest a neoprene sleeve, as shown. The phenolic cap is constructed so as to provide adequate drainage.

On protected transformers a 3/16-inch slot is provided for the lightning arrester terminal. Nothing except the most persistent hummingbird sitting on the arrester could reach the hot terminal—and that's pretty unlikely.

This new bushing is representative of the many plus features found only in L-M Round-Wound Transformers®—and another reason why you should order more L-M Round-Wounds. Ask the L-M Field Engineer to tell you other reasons for buying these outstanding and highly efficient transformers. Or write Line Material Co., Transformer Div., Zanesville, Ohio.

BH-B

LINE MATERIAL Transformers

McGRAW-EDISON COMPANY

EDITORIALS

Trees and Utilities Can Live Together

The basic approach to solving the classic conflict between street trees and overhead lines and street lights has been made. Agreement has been reached among utility men, arborists, and municipal officials that the solution lies in the programmed replacement of forest trees on city streets with low-growing species that fit the space and environment.

Although from Connecticut to California cities are adopting master street tree plans and enacting model control ordinances in cooperation with electric companies, the program is being held back because of a lack of nursery trees, builder interest, and FHA coordination.

The rapid growth of tree planning programs has left the commercial nurserymen comparatively unable to meet the demand for the new species. There are only two wholesale nurseries now able to supply the tree species being called for in any volume. More are obviously needed if functional tree planting programs are not to bog down from lack of trees. Estimates of planting requirements of programs now outlined would reduce the business risk of commercial nurseries who must propagate seedlings five to ten years ahead of planting.

Guidance of the street tree planting in real estate subdivisions and unincorporated areas is vital in the face of the explosive pace of home building today. Unless home builders understand and participate in tree planning programs, the improper selection of trees for new home sites will multiply faster than solutions can be found.

As matters stand today, specifications of the Federal Housing Administration and Veterans Administration require one tree per lot. But no restrictions or recommendations are included as to the species to be planted or the location with respect to utilities. This too needs correction.

There are no insurmountable obstacles to having both trees and overhead lines on the streets of American cities if the trees fit the space and environment. It remains only to spread this concept among groups that can help put it to fuller use. In this the Street Tree and Utility Conference is doing an effective job.

Today's Transmission Voltages Are Obsolete

A general upward adjustment of transmission voltages is long overdue on most major power systems. While the middle voltages that predominate today have served long and well, they are now no longer in economic balance with the accelerating size of generating units in use, under construction, or in prospect.

Today there are about 30 systems in the United States with generating capacity exceeding 1,000 Mw. Another 30 systems have between 500 and 1,000 Mw of generation. In another decade the number of 1,000 Mw systems will double. So there will be a new crop of companies faced with the task of handling these heavy capacity requirements.

Transmission at 138 kv is the backbone of bulk power transfer in the U. S. today. Its selection was frequently related to turbine generator and transformer unit designs of 50 or 60 Mw per circuit, or higher in some instances. But today, according to a recent survey of plant designs now scheduled, over half the capability is in generating units of 150 Mw and larger. Ten years hence as the economic size of units increases with growth of system load, companies now installing 150-Mw units will be adding 300-Mw generators. Even today there are several machines on order rated 300 Mw and above including two 450-Mw units.

Transmission circuits operating at 230 kv or 345 kv will be increasingly needed in the years ahead to balance with unit sizes in use. Voltages above 400 kv will be needed by many of the larger systems for economical bulk power supply.

But what of today? Medium voltage transmission now being planned will still be young ten years from now when power plant capacities and associated transmission needs are double what they are today. This prospect argues strongly that as system transmission voltages are increased, the upward adjustment should be big enough to match the realities of the future. Moreover, as new lines are laid out, their designs should contemplate the probability of conversion to a higher voltage.

SEN LYNDON JOHNSON (Dem-Tex.) is met by Clyde Ellis, (left) NRECA general manager, before quick trip to hotel

Co-ops Gird for

Lack of public support, higher interest rate prospects, power supply are problems aired at NRECA annual meeting

Leaders urge broadened cooperation and a U. S. public information program

In much the manner that a farm or ranch boy reacts to his 21st birthday, the National Rural Electric Cooperative Association met in Chicago last fortnight to take a sometimes critical look back at 21 years of operation, flex its muscles, and lay plans for the future.

The city's block-long Coliseum was the scene for crowded general sessions at which three U. S. senators, the organization's leaders, and co-op managers and directors appealed for broadened cooperation. And reasons behind the appeals—lagging public support, prospects for higher interest rates on REA loans, and growing power supply problems—are among the most serious faced by NRECA since its start, according to many speakers.

Their diagnosis was followed with prescriptions for a national public information program. It would strive to gain support for legislation on federal atomic power projects, multi-purpose water programs, and maintaining the 2% interest rates on REA loans. It would help kill the "legalized profiteering" that rapid tax amortization and depreciation write-offs provide for private power companies, the speakers said. And an information program would arouse the interest and sympathy of co-op members and the citizenry.

"We know the private power company propaganda drive is eroding away the sympathetic support of the general public," said Clyde T. Ellis, NRECA general

SEN PAUL DOUGLAS (Dem-Ill.) won Co-op members' support for a federal capital budget accounting proposition

DAVID HAMIL, left, REA administrator, gets congratulations of outgoing NRECA Pres J. E. Smith after Chicago speech

Teamwork, Prescribe Information Push

manager. "And," he asked, "are we sure that our own members are not tending to swallow the same propaganda hook, line, and maybe the sinker?" He blasted the practice of "bigness" by private companies but told the more than 5,000 meeting-goers the technological and political advantages of the "giant" are necessary.

Carl Hamilton, editor of the Iowa Falls Citizen and Hardin County Times, suggested that co-ops combat an "utterly lousy job on public relations." His advice: Don't try to match the opposition on a dollar-to-dollar basis or try to "buy" public relations, but adopt a national program distinguished by statesmanship.

About 43% of big city Congressmen vote with REA's 75% of the time or more while only 27% of farm area lawmakers do that well. This analysis by Clay Cochran, director, NRECA legislation and research, brought a call for co-op "political minute men." These men and women would keep abreast of federal and state legislation and voting records. They would hold education and political action campaigns that "in from two to five years could make our position absolutely impregnable," he said.

Live and Let Live?

Among the headline speakers, REA Administrator David Hamil and Sens Lyndon Johnson (Dem-Tex.) and Edward Thye (Dem-Minn.) advocated varying degrees of public and private power cooperation.

Hamil said both will be needed to fill the nation's power job. "Many (REA) borrowers have found it profitable to work with other power systems in planning future expansion," he remarked. One of the best—interconnection and exchange of power—is "a common sense way to cut the cost of expanding capacity and producing power for the farmer," he said.

The co-op ownership and company operation feature of the contract between Central Iowa Power Cooperative and Iowa Electric Power & Light Co is a good case in point, Hamil added. Contracts that are mutually beneficial and provide farmers with the best service should be a co-op goal.

According to Johnson, "There is no disposition in Congress to hamstring or hamper free private enterprise in any field. But neither is there a disposition to sit idly by while the confidence of the people is undermined in institutions which the people themselves have built," he said.

The attacks on TVA and REA go on, Johnson said, "pitched in a low key; cloaked in suave blandishments; and couched in 'appeals' to the public interest. Because the technique is so apparently reasonable, it is doubly dangerous."

Thye, a member of last year's Senate lobbying committee branded as discriminatory by NRECA, told the co-op managers and directors "the time has passed when the industry can afford the luxury of permitting prejudice and suspicion between public and private power . . . to interfere with efficient over-all development of our national power resources." He recommended joint plans such as three co-ops and three companies have worked out for Missouri River power distribution in Minnesota.

Sen Paul Douglas (Dem-Ill.) won support of members and their resolutions committee for a proposed federal capital budget method of accounting that would counter-balance expenditures with equal amounts carried on the books as assets.

Private utilities are "sneaking in the back door" of the Treasury, Douglas charged. Their rapid tax amortizations have amounted to about $4.7 billion, he said, adding that liberalized depreciation provides another "subsidy" amounting to more than six times the investment in the rural electrification program.

"I would not favor an increase in interest rates" for REA loans, Thye said. He added that if it does come before the Senate it wouldn't be approved.

MISS RURAL ELECTRIFICATION, "Bunny" Wells, center, of Kentucky and escorts Carol Seeley, right, and Angela Hunt

OFFICERS: Pres John George, Lewiston, Idaho; Sec-Treas Al Hauffe, Leola, S. D., and VP Lee Hatley, Morganton, N. C.

Johnson deplored tight money policy as one of the Administration's great mistakes when asked about prospects for such a bill. "If, in the next four years, we are forced to pay more for government money, rural electric co-ops will have to face up to the fact" that some adjustments will be made, he said.

The pressures for keeping the 2% REA rate were spelled out by Clay Cochran, who said interest payments took over 9% of the rural electric systems' revenue in 1955. He estimated the bill introduced by Rep Edgar Hiestand (Rep-Calif.) would up REA rates to nearly 3%. Cochran warned that an increase "would deliver many of our systems into the hands of the power companies."

Power Plans and Problems

Average purchased power costs for all rural systems dropped from 1.09¢ per kwhr in 1940 to 0.72¢ in 1956, Leland Olds said. Charges paid private suppliers decreased from 1.24¢ per kwhr to 0.86¢, or by more than 30%, said the director of Energy Research Associates and former Federal Power Commission chairman.

Future demands, Olds continued, will make wholesale power supply a major cost element, increasing from under 10% to as high as 60% of consumers' bills. His suggestions included a long range plan to determine possibilities and limits of federal river-basin supply; study of larger, more efficient generating and transmission (GT) stations, including joint districts made up of municipals and co-ops; secure legislation requiring private regional wholesale power systems or pools to supply public and co-op systems, as well as private.

Cause of the many municipal sell-outs in recent years is the lack of "decent laws by which municipally-owned systems can join together to generate their own power and transmit it among themselves", Olds remarked.

GT loans now account for more than half the $124.5 million in applications held by REA, Administrator Hamil said. Borrowers plan $957 million in new construction in the next five fiscal years 1958-62. Of this about 60% will go for system improvements and GT facilities, he added.

If co-ops hit snags in negotiation for reasonable wholesale rates, REA will authorize GT loans for those systems wanting to generate power, Hamil stated.

And when nuclear power becomes feasible REA will assist co-ops in getting it, Hamil pledged. But he advised waiting until costs come within reach.

"The co-op that loafs along at a Model T pace in today's business traffic is a hazard to itself and its community," Hamil said. Power-use promotion, a bigger role for farm women, and area development were his recommendations. "I'd like to see all of you working to attract more industry."

A program for public utility district laws in all states was advocated by Cochran. With them "we could say to any arrogant power company, 'If you insist on destroying our cooperative, we will retaliate by taking over your whole area around that in which we operate'."

To cure the sell-out "virus," Joe Jenness, NRECA's assistant general manager, detailed lessons learned from last year's recoveries at Cody, Wyo., and Guin, Ala. His advice: Keep members informed and "sold" on what they have in their equity; eliminate or curtail proxy voting; stagger board of director terms; and "reestablish rural electrification" with the public.

With practically all farms now getting service, "vertical expansion is the direction we must take as we arrive today at the great crossroads of commerce," said outgoing NRECA Pres J. E. Smith. "With the styling of 1960 and beyond in mind," members should make stronger state-wide associations, "cross-breed" with sympathetic groups, and go all-out with the Willie Wiredhand symbol.

In final session delegates approved 56 resolutions. The measures ranged from job training plans and legislator commendations to endorsement of law amendments which would prohibit private companies' "dishonest propaganda advertising."

The advertising resolution urged amendment of the Federal Power Act to forbid deduction of "propaganda" costs as an expense charged to customers, and amendment of the Internal Revenue Act to forbid the costs as an expense in figuring incomes taxes.

EURATOM Pact Means Money to U. S.

. . . if a strong program can be developed for selling atomic equipment abroad. By 1967, Europe may be the world's leading producer of nuclear power

The need for the United States to carve out a piece of the international market for atomic equipment grows more acute this month as six European countries prepare to sign a document making them members of a supranational European Atomic Power Agency.

The U. S. government has officially blessed this EURATOM program already. After ratification by member nations, the program will mean 15,000 Mw of nuclear power capacity in Europe by 1967—presumably distributed among the members: France, Germany, Italy, Belgium, Luxembourg, and The Netherlands.

Even though the EURATOM pact probably will not be ratified until mid-1957, the nations reportedly feel they can go ahead with plans which may make western Europe the leading nuclear power center in the next decade.

The plans call for installing 3,000 Mw of nuclear power capacity per year for five years, starting in 1962. That compares with U. S. plans to build about 1,800 Mw by 1962, and Russia's goal of 2,500-Mw by 1960. EURATOM's 15,000-Mw goal would be equivalent to 250 Shippingports or to 166 Calder Halls.

Specifically, here are a few foreign plans for the coming years (Sweden, Britain, and Japan not being part of the EURATOM group):

• **In Sweden,** two 75-Mw thermal plants are to be built in the next four years. One a year is scheduled for completion in 1961-66. A 100-Mw power station is planned for 1963 and a still larger unit is slated three to four years later.

• **In Belgium,** the timetable calls for one power reactor every three years between 1958 and 1968, and one new power reactor every two years thereafter. Converters of 100-Mw capacity with a plutonium output of 200 lb a year are to be working by 1963. A more-advanced type converter is planned for 1966, and a true plutonium breeder is scheduled for 1968.

• **In England,** the British have announced a "new power revolution" which would triple production of nuclear energy for industry by 1965. The $2.6-billion program has as its goal production of between 5,000 and 6,000 Mw in 20 stations.

• **In France,** insurance companies seem to be pacing atomic progress. The French Federation of Insurance Corps, announced that it was ready to guarantee risks arising from production and use of atomic power. Coverage will be provided by a pool of about 100 French companies through a special atomic risks insurance pool.

• **In Japan,** 3,000 Mw of atom-generated power should be produced in 1962, says Koichi Uda, chairman of Japan's Atomic Energy Commission. But observers believe such rapid development of Japan's atomic facilities is unlikely.

However, Mitsubishi Electric Mfg Co is believed planning to build a pressurized water type atomic reactor with technical aid and parts from Westinghouse.

Five of Japan's ten electric power companies now are studying atomic plans for: A 100-Mw natural-uranium reactor, a 10-Mw reactor, a two-reactor (heavy and light water moderated) 10-Mw plant, a 50-Mw pressurized water reactor, and a 150-Mw reactor.

NUCLEAR NOTES

New England has responded to recent criticism directed at the Atomic Energy Commission's contract with Yankee Atomic Electric Co. The point has been raised that the contract was made in good faith, and that sponsors of the Rowe project prefer to base their participation on percentages of cost and of energy supplied to them individually by Yankee instead of flat sums of money. As for financial competency, it has been emphasized that assets of the 12 sponsoring utilities possess close to $2-billion in strength and resources.

Aerojet-General Nucleonics has announced that the second AGN 201 training and research reactor went into satisfactory operation at the new San Ramon production facility. It was to be shipped to Philadelphia last week for first public exhibition of a reactor in the U. S. at the 1957 Nuclear Congress.

The AEC has announced that it will set up chemical processing services for operators of private nuclear reactors. Individually negotiated contracts will establish firm charges subject to:

• Escalation on the basis of an appropriate price index.

• Cancellation by AEC after 12 months' notice, upon determination that similar services are commercially available at reasonable prices.

Exchange of classified and nonclassified research data on controlled thermonuclear reactions has begun between the U. S. and the United Kingdom.

First commercial shipment of nuclear reactor fuel elements to The Netherlands has been announced by Babcock & Wilcox Co. For use within the Atoms for Peace framework, they are the first 20%-enriched uranium-aluminum alloy type elements ever sent abroad. The 20% enrichment maximum has been set by regulation for use in foreign research reactors under President Eisenhower's program.

Jensen Hits Seaton Study of Pleasant Valley

Hells Canyon battle flares as veteran Congressman questions "real need" of flood storage provisions in federal dam plan for Snake River

Antagonists in the old battle over development of the Snake River are at it again. Pro-federal-power Congressmen are making another—and almost certainly futile—effort to win a Congressional nod for a federally built high dam at Hells Canyon to produce power for preference customers.

Hearings started last week before both the House and Senate Interior Committees. Lead-off witnesses were such federal public power exponents as Sens Wayne Morse and Richard Neuberger (D-Ore.), and Rep Gracie Pfost (D-Idaho).

Jensen Supports PNP

A veteran Republican on Reclamation and Power Dam Affairs, Rep Ben F. Jensen of Iowa, threw his weight behind Pacific Northwest Power Co's proposal to build two dams, at Mountain Sheep and Pleasant Valley.

Jensen's letter to FPC Chairman Jerome K. Kuykendall last week argued against the federal alternative. His letter probably will carry more weight with the FPC than will the hearings on Hells Canyon.

Jensen is ranking Republican on the Dept of Interior Appropriations Subcommittee, second-ranking GOP member on the Public Works Subcommittee (where a Hells Canyon money provision would be considered), and third-ranking Republican on the full 50-man Appropriations Committee.

"Ignore Seaton's Letter . . ."

In effect, Jensen told Kuykendall to ignore a recent letter from Interior Secy Fred Seaton regarding the Pleasant Valley situation. Seaton had told the Commission officially that he is having a full study made of the area to determine the best means of developing the river.

But Jensen said the study will add "little if anything to the facts already known."

Here is the sequence of events that led to the now-complex Pleasant Valley situation:

1. Pacific Northwest Powers Co's application to FPC, Sept. 1955, for a license to build a $234-million, 1,200-Mw hydro project below Idaho Powers Co's proposed Hells Canyon Dam on the Snake. The PNP project includes the Mountain Sheep and Pleasant Valley Dams. The PNP application was opposed by several public power organizations led by National Hells Canyon Assn. FPC concluded its hearings Dec. 19.

2. Revelation in December that the Bureau of Reclamation had been preparing a report on the possibility of building a higher Pleasant Valley Dam than that contemplated by PNP at the same site. Such a dam, if built, would flood out the Hells Canyon site licensed to Idaho Power.

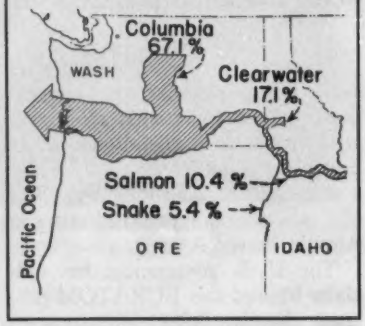
3. Jensen's letter to Kuykendall —obviously intended to offset whatever influence the Seaton letter may have on the course of FPC's deliberations on the PNP application.

Jensen told Kuykendall that Seaton's letter and report on the possible high Pleasant Valley Dam appeared to have one objective only—that of providing a "financial contribution to future irrigation projects in the Snake River Basin."

To this Jensen added: "As there is presently no law that provides for construction of this project by the federal government nor for the use of power revenues therefrom to subsidize uneconomic irrigation development, the assumption inherent in this stated objective appears to be somewhat premature . . . I would go farther and say the entire report was outside the Bureau's responsibility."

Seaton justified his intervention on grounds that his preliminary study indicated improved flood control storage possibilities for a higher Pleasant Valley Dam and improved power capacity.

Here's How 4 Rivers Contributed to a Flood



As to the power aspect, Jensen said the record is clear that "no additional head would be developed by the substitution of a higher Pleasant Valley Dam for the presently proposed Pleasant Valley Dam and the Hells Canyon Dam licensed to Idaho Power. Nor would there be any material difference in total power production . . ."

Jensen also questioned whether there is a "real need" at this site for 800,000 acre-ft additional flood storage that would be gained by a higher dam. He provided Kuykendall a map of the Columbia River Basin showing that the Snake contributed only 5.4% of the water in the "disastrous 1948 flood" on the Columbia. Therefore, said Jensen, if Reclamation and Seaton "are truly interested in effectively reducing flood flows on the main stem of the Columbia River, they can better expend their efforts elsewhere than on the middle Snake River."

The Congressman further criticized the potential high dam on grounds that it would waste taxpayers' money.

Meanwhile the FPC legal staff was scheduled to file its legal brief on the PNP application March 15. PNP's final brief and rebuttal is due April 1.

Best information in Washington is that Reclamation will not have its more detailed study of Pleasant Valley completed until early 1958. But will FPC wait that long? Indications are that it will not.

Utilities Launch Plans to Uproot Tree Troubles

Utility delegates and arborists meet to solve trees-and-lines problems

Information on long-range street tree programs is exchanged as industry attacks costly headache

TREE CONFERENCE CO-CHAIRMEN each represent one sponsoring group. L to R J. W. Anderson, Philadelphia Electric Co for Edison Electric Institute; Kirk M. Reed, General Electric Co, for Illuminating Engineering Society, and Edward Scanlon, Taylored Tree Nurseries. The National Shade Tree Conference

A flood of reports telling of the inauguration and expansion of long-range street tree programs and other measures to eliminate tree conflicts with overhead lines, street lights and other services, marked the 2nd Street Tree and Utility Conference in Cleveland recently.

Magnitude of the conflict between trees and overhead lines was sketched, on a national scale, by Harry T. Sealy, vice-president of Cleveland Electric Illuminating Co. He estimated that about 6 million miles of power and communication lines in the U. S. today are affected to some degree by 400 million trees. Power companies estimate that 9 out of 10 cases of trouble are caused by trees, Sealy said. He cited an EEI-AIEE study showing that trees play some part in ⅓ to ½ of all total power system faults.

Putting lines underground is not the answer, Sealy said. It would cost CEI $430 million—equal to the company's entire investment in property and plant—and would require a substantial increase in electric rates. However, cooperation and planning on the part of everyone will enable trees and utilities to exist in harmony, Sealy said.

CEI Uses Arborist

What the Cleveland company is doing among the cities and municipalities it serves was told by Edward H. Scanlon, CEI's consulting arborist. Since 1954 the company has made Scanlon's services available at no cost to prepare "Master Street Tree Plans" for neighboring communities to guide the planting of low-growing trees. To date 26 such plans have been requested and 13 completed. Some 646 miles of streets have been planned calling for the planting of 6,600 trees.

The Detroit Edison Co in addition to distributing its booklet, "Planting for Permanent Beauty", has had its "Study Tree Ordinance" adopted as a guide by 15 local governments in preparing regulations of their own. A test planting site has also been started where species of low-growing trees recommended by the company will be on display, Robert J. Kelly reported.

Philadelphia Electric Co has adopted a tree program similar to that of CEI, J. W. Anderson told the conference. In the eight months since the program was launched the company has received 13 requests from municipalities for master street tree plans. Eight plans have been completed involving surveys of 437 miles of streets. Some 60 tree species have been recommended for 1,285 street locations, he said.

Central Hudson Gas & Electric Co is offering a program of street light pruning to municipalities in its area, in an effort to help them get the most for their street lighting dollar, Taylor Barr said. Towns that are without mechanical equipment, or that are unable to obtain independent tree service for street light pruning, may have the work done by Central Hudson crews when they are on the street trimming for line clearance. The community is charged on a per hour basis for each "sky-lift" crew.

Connecticut's "Remarkable Record"

A remarkable record of accomplishment by utility companies in Connecticut was reported by Herbert J. Cran, arborist for Connecticut Light & Power Co. In a detailed city-by-city report he told how companies in the state are working with community improvement associations, planning and zoning commissions, garden clubs, nurseries and the State Highway Department to promote a sound functional tree planting program and to eliminate diseased, structurally weak trees.

The need to guide street tree planting in real estate subdivisions and unincorporated areas was described by William Siden as the most pressing single discovery since Pacific Gas & Electric Co launched its tree program in 1953. To meet the situation PG&E has persuaded home financing agencies, like FHA and VA, to adopt its recommendations on tree species for residential

plantings; is educating real estate developers, and is actively promoting model tree-control ordinances at the county level.

To utilities launching tree programs, PG&E recommends that they first attack the source of new plantings. Save the removal of old trees as a long range effort, Siden said. Otherwise the problems posed by improper selection will multiply faster than solutions can be found.

In like vein, S. R. Carr, past president of the National Association of Home Builders, urged that help be given home builders with tree selection. Most builders today buy raw acreage and develop it. If there is to be any tree planting done, he said, the developer will do it. Carr urged that "good solid information" about tree selection and planting be brought before these men who build by far the greater proportion of houses in this country.

A note of warning that the rapid growth of tree planting programs has left the commercial nurseryman comparatively unable to meet the demand for new species was sounded by James I. E. Ilgenfritz, past president of the American Association of Nurserymen. The sudden demand for unheard-of tree types is creating confusion. Moreover, divergence of purchase specifications is also a problem, he said. He pointed out that 7 to 12 years are required to propagate a tree for planting. Difficulties of estimating demand this far in advance is multiplying the business risk assumed by nurserymen.

Henry T. Skineer, noted director of the National Arboretum, Washington, D. C., like Ilgenfritz, warned that it may be 10 years or more before supplies of new tree selections will be of significant proportions. He predicted that for many years supply will fall far behind demand, except for those items already in general nursery supply.

Utilities and Reclamation Create Power Pool

Low water in Rio Grande spurs formal agreement among four non-federal utilities and Bureau of Reclamation. New Mexico Power Pool's backbone is 115-kv system

Four non-federal utilities and the Bureau of Reclamation have entered into a 25-yr pooling agreement covering generating and transmission facilities in the New Mexico Power Pool.

Result of the contract is that the utilities, instead of the Bureau, now will be responsible for meeting power requirements, in excess of capability at the Bureau's Elephant Butte power plant, of customers connected to the Bureau's Rio Grande Project System.

This 115-kv system is the backbone of the New Mexico Power Pool, which has been operating on an informal basis since 1952 (EW, April 14, '52, p 10). Combined installed capability of all pool members is in the vicinity of about 350 Mw.

Water Shortage Prompts Pool

The agreement is designed to improve service and to increase generation and transmission efficiency for all parties. It was prompted partially by a prolonged surface-water shortage in the Rio Grande. This shortage seriously curtailed firm power production at Elephant Butte.

Effect of the contract will be to firm power for Bureau customers and to provide a market for surplus energy from Elephant Butte during years of Rio Grande peak flow.

Parties to the contract, besides the Bureau, are El Paso Electric Co, Community Public Service Co, Public Service Co of New Mexico, and Plains Electric Generation & Transmission Cooperative, Inc.

Terms of Agreement

The agreement provides that the utilities will firm Rio Grande Project power, for project customers, up to 25 Mw—making up any deficiencies in Elephant Butte's production. The utilities will bill project customers directly, eliminating the past need for the United States system to purchase power. During peak flow years, when Elephant Butte dump or surplus power is available, it will be sold to the utilities at 85% of the decremental fuel savings.

The pooling agreement provides for the utilities' wheeling over the Bureau's transmission system at a cost of one mill per kwhr plus associated transmission losses. The wheeling license provides for supply to project customers and for power interchanges among the five parties.

Allocation of transmission losses will be calculated on a unit of 1,000 kwhr per mile of transmission. Losses will be prorated among the parties on the basis of wheeling units delivered by each.

New 115-Kv Lines Needed

A number of new 115-kv transmission lines are to be constructed or improved to increase pool capacity and efficiency. El Paso Electric Co is building a 115-kv line from El Paso to Holloman Air Force Base and White Sands Proving Grounds area to meet growing needs. Community Public Service will build an 8-mi extension of 115-kv facilities from Alamogordo to Holloman to connect with El Paso Electric's new line. In addition, the Bureau is now double-conductoring the portion of the Rio Grande System between Socorro and Elephant Butte.

Dispatching and control of power flow on the Rio Grande System will be coordinated by Bureau operators at Elephant Butte. Each supplier will be responsible for his own reactive power on the system. But generators at Elephant Butte will provide reactive when this does not interfere with delivery of power by the Bureau.

The contract provides for an annual review of current and forecast customer loads to determine the need for additional substation or transmission facilities. The review will establish which of the parties will provide the additions.

Electrified Rails . . .

Signs point to a revival of interest in electrification of some railroads, said David B. Sloan, president of Gibbs & Hill, Inc. He made this observation in an address to the Newcomen Society in North America held recently in New York to pay tribute to rail electrification pioneers George Gibbs and E. Rowland Hill and the firm they founded 50 years ago.

Sloan said recent technological developments have made electrification competitive with diesel under conditions of high traffic densities. Until now, he said, electric locomotives largely have been tailor-made. They have cost about the same as diesels—about $125 per rail horsepower. But prices of rectifier locomotives, using standard, mass-produced direct-current traction motor and gear, have been quoted recently as low as $70 to $80 per rail horsepower on a large-quantity basis, he said.

Development of the rectifier locomotive opens the way for using 60-cycle power on railroads, he said. Utilities would provide the generation, transmission, and perhaps substations. The railroad would install a "light 24-kv overhead contact system employing relatively short wood poles." The system would supply single-phase ac. Extensive studies by a large utility, confirmed by actual tests, showed that many utility systems can absorb satisfactorily the single-phase unbalance without phase balancing equipment, he said.

Serious Problem Solved

Jacksonville (Fla.) police have kept lights burning in the basement of police headquarters for three years now. Sgt Steve Torda, Jr, says this keeps roaches from coming in and licking the glue off envelope flaps—a delicacy they particularly savor.

Lowering the Great Lakes

After hearing an appeal by several Mid-western states in December, the U. S. Supreme Court authorized diversion of an extra 7,000 cfs of water from Lake Michigan into the Illinois Waterway for drought relief down the Mississippi. This diversion, which was to have lasted one month, brought total diversion to 8,500 cfs. Since then, Illinois has successfully sought extensions of the time limit.

Now the Lake Carrier's Assn is hopping mad. It is out to nail the original 1,500 cfs figure as the maximum amount permitted—forever. Ohio and Wisconsin already have thrown their weight behind the Association, and Canada is expected to follow suit.

Canadian engineers see a threat to hydroelectric production at Niagara Falls and on the St. Lawrence River. In three years a potential 443 million kwhr would be lost if the 7,000 cfs diversion is permitted to continue. This includes some power the U. S. would lose, too.

Same Old Story

The Elliott Co, until recently, made good its threat to quit bidding for federal contracts on hydraulic turbine-driven generators as long as foreign companies are acceptable. It turned down in February, 1956, an invitation to bid on generators for Bureau of Reclamation's Roza Project and since then has "consistently refused either to bid or prepare preliminary estimates for the Bureau of Reclamation or Corps of Engineers, feeling that as long as bids were accepted from foreign manufacturers such effort on our part would be purely a waste of time and money," said Sales Mgr F. E. Millan in a letter to Rep Leon H. Gavin (R-Pa.).

Last year, Elliott Co threatened to convert its hydro-turbine facilities at Ridgway, Pa., to other work if government policy remained unchanged. This would mean that the facilities would be no longer available—even in time of an emergency. But so far, the conversion has not come about.

Recently Elliott Co decided to take another look at the situation. It answered a Corps of Engineers invitation to bid on two 42.1 Mva generators for Fort Peck, Mont. Results:

Brown Boveri	$1,398,220
English Electric Co	1,619,933
Elliott Co	1,826,421
Allis-Chalmers Mfg Co	2,028,100
Westinghouse Electric Corp	2,131,564
General Electric Co	2,247,758

"This reconfirms our previous conclusion that it is a waste of time to bid on government projects . . . when foreign manufacturers with low wage scales are permitted to bid," said Millan. He urged Rep Gavin to find out whether President Eisenhower would instruct the Department of Defense to ignore the foreign bids under an Executive Order interpreting the Buy American Act.

Airborne Snow Men

Southern California Edison Co is using the versatile helicopter to fly its "snow men" into the High Sierra to obtain data for predicting the spring run-off. The job formerly required two two-man teams trudging on snowshoes for 10 days at a time in sub-zero temperatures. They had to canvass 18 sampling spots scattered over a 450-sq-mi area that feeds Edison's chain of hydro plants along Big Creek. But using the helicopter, two men handled the job in one day. A Bell 47, G-2 'copter was used in the first recently completed high-altitude (11,450-ft) survey.

Execs Get 'Word' on Appliances, Rates, Sales and Advertising

West Penn's MacDonald . . .

Florida Power's Gracy . . .

Boston Ed's Washburn . . .
and SMUD's Ritchey accept awards.

Utility sales executives at the recent GE-hosted Executive Conference in Louisville were filled in on some important aspects of today's and tomorrow's sales picture. Among them:

• Robert Feemster, board chairman of Dow, Jones Co, told the utility men that they were not supporting the economy as much as they might. Since 1937, utilities have spent a constantly decreasing portion of their disposable incomes for industry advertising and promotion. He told them, "If you remain apathetic now, you remain pathetic in hard times." He also said that selling and advertising were sciences, and that budgets for them should be based on next year's expected load, rather than last year's figures.

• Myrna Johnston, editor of Better Homes & Gardens, said the housewife is 'way ahead of the industry in knowing what she wants in her kitchen.

• George Bogard, GE's utilities relations man, predicted that unit sales volume of appliances in 1957 will be about 6% above 1956; and that by 1966 appliance unit volume will have jumped 75% and dollar volume will have doubled. Bogard told them to look for cuts in distribution costs and increased use of computers for digesting and solving market problems. In 10 years LBE and Housepower are expected to make half the existing homes properly rewired. 1966 will see an electronic home. Heat pumps will drop to ⅔ their present cost.

• C. K. Rieger, vice president and general manager in charge of Appliance Park, said that the trend points to the kitchen as the family room again—as was the case a generation ago, and that the kitchen must, therefore, be warm and inviting as well as functional. Rieger also figures that kitchens will be sold by the package", i.e., as a unit, rather than piece by piece. Appliance design will feature the "Building block" concept to meet many needs. They will be free-standing, but will look built-in.

• R. B. Day, GE's utility specialist, told them to forget load factor and concentrate on productivity in making rates. Day said that there are too variables in the economic picture over which the utility exec has no control for him to limit himself to the relatively restricted load factor approach to rate-making. He said for them to sell the all-circuit home *now*.

Winners of the GE Awards Competition were announced and prizes handed out (EW, Mar. 11, 1957, p 82). They included West Penn Power Corp, Florida Power Corp, Boston Edison Co, and Sacramento Municipal Utility District.

General Electric wound up the meeting with its preview of its Live Better . . . Electrically Caravan (EW, Mar. 11, 1957, p 114), now on the road for a nationwide tour of various state fairs and local trade shows.

Agree and Disagree on Pre-Warming

Speakers at EEI Electrical Equipment Committee meeting agree that generator rotors should be pre-warmed, but how is this to be done?

Generator rotor pre-warming continues to be a controversal subject among utility engineers. While there is general agreement that pre-warming is at least a "step in the right direction," views as to how it should be done vary widely.

This situation was reflected once more at the recent meeting of the Edison Electric Institute Electrical Equipment Committee in Boston (Feb. 11-12). Two reports were presented on the subject.

Field Tests Results Reported

C. B. Sharp traced the derivation of curves that are the basis of procedures used by Baltimore Gas & Electric Co, for the simultaneous warming of generator rotors and the temperature-controlled starting of turbines. Results of several field tests using these curves for both steam rolling-period and turning-gear pre-warming were most encouraging, Sharp said. The objective of integrating pre-warming procedures with turbine starting procedures so they could be done at the same time has been accomplished.

Consolidated Edison Co of New York follows the practice of controlling water flow to generator hydrogen coolers during operation and shut-down so that the unit enters shut-down periods with a rotor body temperature in the neighborhood of 75C plus or minus 5 deg, T. D. Reimers and R. L. Webb said. Storage of heat in the machine under these conditions provides starting temperatures of 60C in the rotor body at the end of 15 to 25 hours depending on the machine.

Con Ed Studying New Method

The authors expressed dissatisfaction with all proposed methods for restoring temperature after more than 24-hour shut-down. However, they are studying a method that combines rotor-field pre-warming while on turning gear, with the circulation of 180F water through generator cooling coils when the machine is rolled on steam. Pre-warming by operation of the machine at about half speed provides the only safe method at present, they said. Permanent direct-coupled excitation system will cost about $60,000. They do not favor it because of the 3 to 5-hour delay in synchronizing a machine after the boiler is ready.

C. L. Derrick said Hartford Electric Light Co cannot justly cost of rotor pre-warming facilities for three older 45,000 kw machines at South Meadow Station. However, pre-warming facilities are being provided at Middletown Station for a newer larger machine there. Elmer De Turk said Long Island Lighting Co engineers are concerned over the lack of relay protection of machines during half-speed, half-frequency pre-warming. He hinted that a practical way to accomplish protection is under development.

Other Utilities Report Progress

Detroit Edison Co reported "considerable trouble" in getting and holding the 60C rotor body temperature recommended. They have compromised on 30C as offering "real help". Walter Morton said Pennsylvania Power & Light Co is inclined to believe that rotor pre-warming is not necessary. However, PP&L follows a bottling procedure to hold 60C when machines are shut down on week-ends. For longer periods a bottling and a pre-warming procedure is followed not because it is felt to be necessary but because it is a step in the "right direction," Morton said.

Among the electrical features associated with the new 160-Mva unit at Salem Harbor Station, described by E. O. Erickson, New England Power Service Co and M. T. Stantial, Stone & Webster Engineering, were these:

- Use of a ground fault neutralizer for grounding the generator. It was described as the first in the U. S. of its type. Grounding of this type limits fault currents to less than one ampere and makes immediate generator shut down unnecessary in event of a ground fault.
- Connections between the generator and the main transformer bank consist of nine cables per phase arranged in three circular duct banks 26 in. in diameter. The three duct banks are in triangular formation. Circular arrangement provides nearly equal current distribution in the generator cable system and avoids expensive terminal manholes for phase collection, at the generator and transformer.

4 Ways to Match Breaker Duty

Experience derived from 11 years' operation of oil circuit breakers with an over-duty ratio of 2:1 is used by Pennsylvania Power & Light Co as a guide to circuit breaker operation on the system. In the 11-year period 250 cases of trouble were experienced resulting in 52 cases of circuit breaker failure, J. K. McDonald, told the committee. He outlined four ways of reducing the ratio of duty to interrupting rating for over dutied breakers: **1.** Increase the time delay between reclosures, **2.** Reduce duty on bus with sequential tripping, **3.** Reduce the number of reclosure on severe faults, **4.** Block tripping for severe faults.

In a paper on transferred tripping, C. L. Headley revealed that Baltimore Gas & Electric Co is planning to install frequency shift, transferred tripping equipment on its microwave channels. The Baltimore installation will be one of a very few in existence on utility systems.

Microwave Installation Satisfactory

Since 1953 the Baltimore utility has had three microwave channels in service carrying eight relaying circuits and three transfer trip functions. Since installation the equipment has operated satisfactorily, without interruption or any special attention through weather ranging from 100F to near 0F, heavy rainfalls, electric storms and high winds, including several hurricanes with winds ranging up to 75 mph, C. L. Headly reported.

Resembling plowed field, this bitumen-striped wall will hold water for needed power as . . .

Germans "Build" Lake for Pump Storage

A huge artificial lake with a capacity of 124 million cu ft of water is now nearing completion at Geesthacht, Germany.

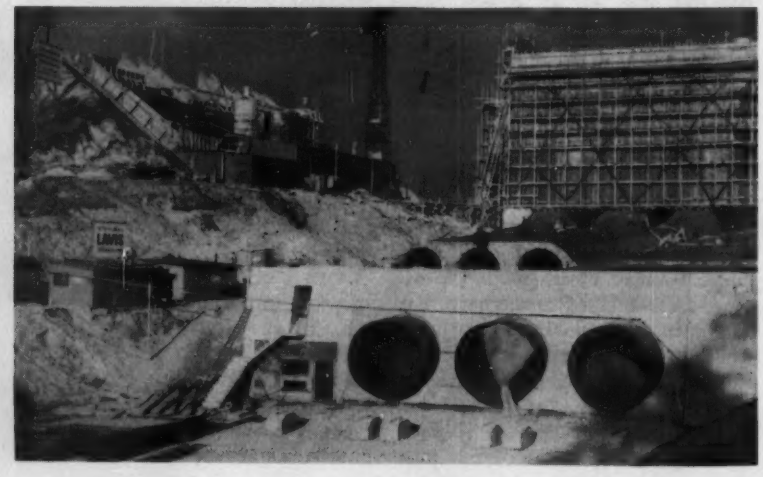
The lake is being built to supplement the electrical power supply of the city of Hamburg, about 40 miles away. According to engineers, the stored energy soon available from the lake will generate about 500,000 kwhr. At present the city's power supply comes mainly from steam turbine power plants.

When construction is completed, powerful electric pumps will be used to fill the lake with water from the nearby Elbe River. These pumps will operate at night, when Hamburg's power requirements are at their lowest.

Then, during the daytime, the stored water will rush down through giant pipes at the rate of more than 8,000 gallons each second. These pipelines, which are embedded in concrete, lead from the dam (located in rear of the lake, bottom right photo) to the turbines linked with generators at the power station.

Above photo shows workmen applying bitumen to the lake's walls to combat seepage and erosion as the lake is filled and drawn down.

Workmen clean each completed section as tubes are laid from dam to power station



Poor George doesn't know...
ONE PENNY WARMS AN ELECTRIC BLANKET FOUR HOURS
Look what your electrical penny buys
Electricity's penny cheap
NSP
NORTHERN STATES POWER COMPANY
Poor George doesn't know...
ONE PENNY RUNS A SEWING MACHINE FOUR HOURS
Look what your electrical penny buys
Electricity's penny cheap
NSP
NORTHERN STATES POWER COMPANY
Poor George doesn't know...
ONE PENNY KEEPS A FOOD FREEZER COLD 4 HOURS
Look what your electrical penny buys
Electricity's penny cheap
NSP
NORTHERN STATES POWER COMPANY

Northern States Power Shucks Static Approach as . . .

'Poor George' Makes His Point the Hard Way

When Northern States Power Co contemplated a change of pace for its two-year-old cartoon-type ad series, they turned to photographs. The results can be seen in the three ads pictured above.

"We felt the positive approach of someone using electricity would be static," says Lawrence J. Donley, NSP advertising manager. "Actually none of us can recall at just what moment 'Poor George' was decided on," he adds. But "once we had agreed to use the humorous negative approach and do it photographically . . . we decided to have a central character to tie this campaign together."

"Poor George" is portrayed by Clellan Card. His mugging for a Minneapolis station's show has won a wide TV following. The choice was understandably unanimous.

Where and how do they get the props? An imaginative photographer whittles wooden needles, suspends a fish by wire until frozen, and realistically tailors composite shots. NSP men help out by rounding up 100-year-old stereopticons, washtubs, et al. From these samples it appears NSP has achieved its aim of eye-catching illustrations to pull readers into their advertising copy.

Plant engineering personnel from industries in utility's service area . . .

Utility Turns Industrial Customers

- **More than 125 companies are represented**
- **Quiz show techniques and appliance prizes keep up interest of students**
- **Graduates become boosters for good lighting in their places of employment**

L. P. FRIES, Manager—Power Sales, New York State Electric & Gas Corp, Binghamton, N. Y.

A creative, mass selling technique organized by the New York State Electric & Gas Corp, is expected in effect to add the equivalent of 300 new industrial lighting salesmen to the utility's power sales staff. Heart of the plan is a seven-week industrial lighting conference sponsored by NYSE&G for plant engineering personnel of industries in its service area.

The program, begun last October, employs similar tactics to the mass selling plan for industrial electric heating promotion now employed by some 38 utilities. Plant engineers of NYSE&G's large industrial customers in a given area are invited to select their own representatives to attend the weekly conferences. Each participant pays a $5 entrance fee, which contributes to the cost of prize incentives for participation, and is given a 165-page textbook prepared by the power sales department.

Conferences, held between 7:30 and 9:30 PM, begin with a fundamental description and demonstration by the conference leaders, followed by group participation in problem examples. After this, "Homework" is assigned for further practice on such problems before the next meeting.

A seventh and informal session begins with a dinner for all the conferees. After the dinner each man receives a certificate of proficiency in lighting, and authors of prize-winning layouts present brief discussions of the lighting problems involved.

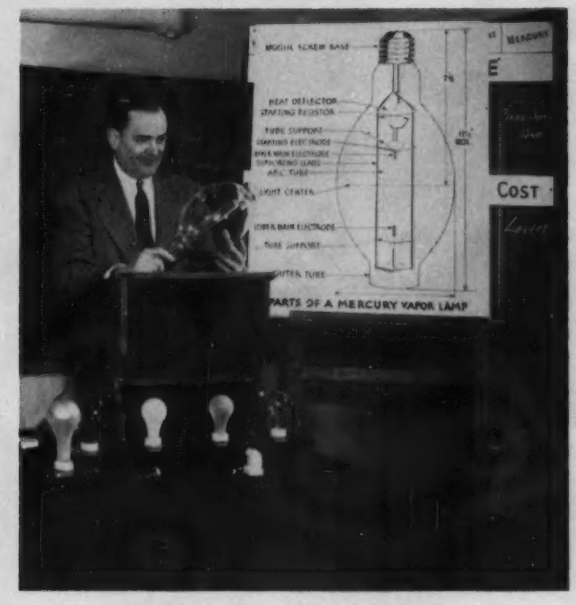
Five conferences have been completed, and four more are underway. Each conference series runs during concurrent weeks. A demonstration team of two men from the Power Sales Department travels the circuit in rotation using a station wagon to carry fixtures, charts, and other demonstration material from one location to the next. Various manufacturers have loaned a variety of equipment for demonstration and display purposes.

Almost All Members Do "Homework"

Registration for the conferences averages about 35, runs as high as 49. So far 125 companies have been represented. Participants' attendance runs about 85%, and 92% of these have turned in "Homework".

L. P. Fries, the utility's manager of power sales, reports the program has not only boosted lighting load but has proved to be highly popular with both conferees and plant managements. He believes the conferences have shown conclusively that once these men inside industrial plants understand good lighting practice, they become highly effective salesmen for lighting improvements in these plants.

Since the program started, representatives of four other utilities have sat in on the sessions and are planning conferences of their own patterned after the



Master good lighting techniques . . .

In sales department program . . .

into Salesmen

program of New York Electric & Gas Co.

The first meeting is devoted to the Science of Seeing —how the eye works and the part light plays. Following a break for coffee and doughnuts, laboratory experiments are given to demonstrate how much light is needed for different seeing jobs. Each participant is shown how to use the light meter which is loaned at time of registration. "Homework" assignments call for practice in measuring light with the light meter at home and at the plants where they work.

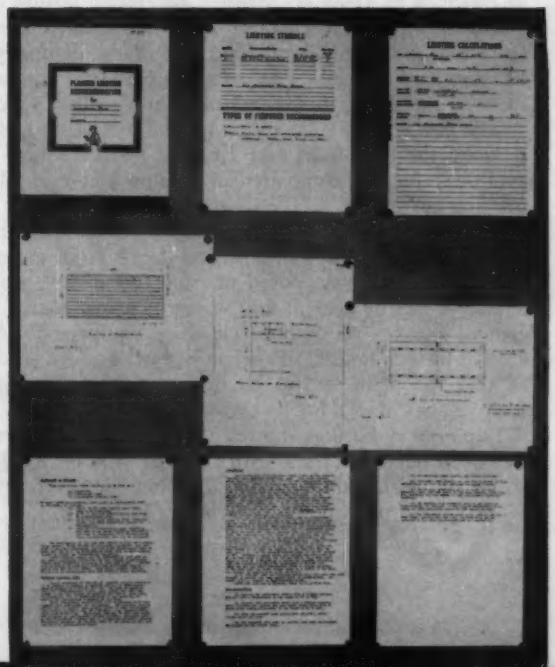
Make Layouts for Own Plants

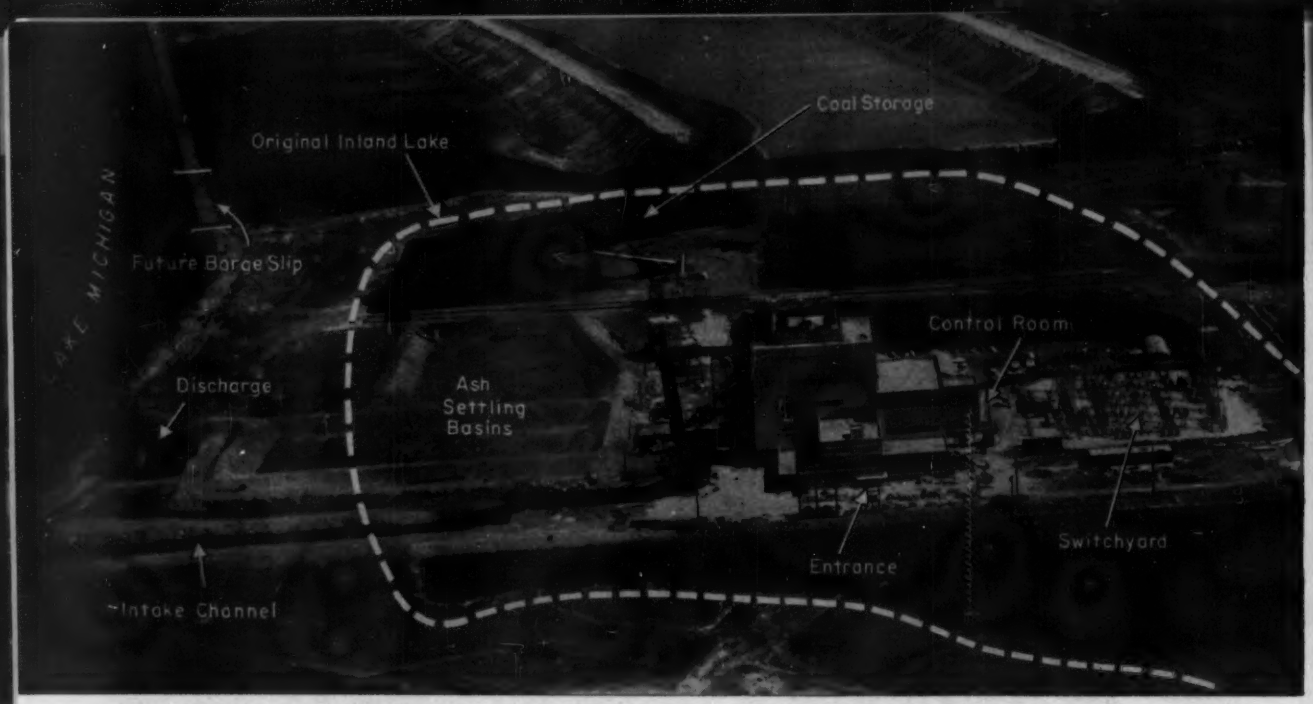
Later conferences, following this same pattern, take up technical fundamentals, kinds of light sources, drafting room and office lighting, lighting in production areas, and complicated industry lighting problems. By this time "Homework" assignments consist of preparing actual detailed lighting layouts for some part of the participant's own plant. In the majority of cases lighting levels specified in these layouts have called for 50-ft-c or above.

"Homework" is judged at each meeting. From two to five prizes, such as floor lamps, table lamps, steam irons, toasters, clocks, or light meters, are awarded. Interest in light meters has been marked. Several men who did not "win" one purchased one for their personal use. Quiz show techniques are also employed, with silver dollars for prizes, to check programs and stimulate interest.

The company has been extremely satisfied with the success of the program. It is too early to measure tangible results. But it is expected that the program will pay off for many years.

Winner describes layout (below)





PLANT LOCATION on steel mill's dumping ground on shore of Lake Michigan, although close to heavy load center and to cooling water supply and railroad facilities, made necessary an unusual adaptability of engineering to the site

Builds Plants 5 Miles from Heavy

GENERATION
Design

Northern Indiana Public Service starts lakeside station instead of old plant expansion, despite site handicaps

H. H. McMEEN, Partner, Sargent & Lundy, Chicago, Ill.

R. M. SCHAHFER, Vice President, Northern Indiana Public Service Co, Hammond, Ind.

Availability of ample cooling water and railroad facilities prompted Northern Indiana Public Service Co to establish its Dean H. Mitchell generating station on a new site on Lake Michigan. The plant is only 5 miles from the middle of Gary, Ind., one of the company's heaviest load centers. The company preferred building there to expanding its existing plant at Michigan City.

The new station is on a strip of land extending 1,663 ft along the lake front and 2,620 ft inland. Were it ever desirable, the company can develop a lakeside slip for coal barges.

This site had some disadvantages. The fill, composed of slag, kettle bottoms, and debris from a steel mill 2½ miles away, posed unusual foundation problems. A nearby cement mill was a probable source of cement deposits on outdoor electrical equipment. An area ordinance limited the height of stacks above grade, so that the plant had to be designed for two, short, high-velocity stacks for its single boiler.

Exploratory borings showed that the slag and debris had been deposited on a 15-ft layer of sand on a 50-ft strata of weak clay. Under the clay, however, was 30 ft of hard pan on natural Niagara limestone.

The plant is in what was a land-locked pond until it was filled with some 300,000 cu yd of sand. As clay or sand displacement could unseat point-bearing piles, 70,000 ft of H-piles were driven to hard pan. These averaged 90 ft long. Pile caps and basement floor were placed at grade level. A total of 400,000 cu yd of slag fill was used at the plant site, of which 201,000 cu yd were in two slag hills.

Brick and Aluminum for Walls

Office sections are of face-brick-wall construction, and a combination of face brick and insulated metal panels extends from slightly below the plant's operating floor level. Outside sheets of paneling are aluminum; inside panels plain steel with perforations for sound absorption in critical noise areas. Outlying buildings are similar to the main building.

The boiler is a divided-furnace, pulverized-coal-fired unit equipped with natural-gas burners. Boiler capacity is 860,000 lb per hr at 1,800 psi.

Conventional coal handling equipment includes a track hopper with car shaker capable of unloading two 70-ton cars simultaneously. Storage coal is conveyed from a track hopper to a stocking-out, pivoted conveyor operating on a circular track. This conveyor piles coal for bulldozer operation or takes coal to a 100-ton storage hopper for carryall operation. The

Load Center

crusher house is in the conveyor system to the plant.

Four pulverizers with integral exhausters supply coal to 32 tilting, tangential burners, four high at eight corners of the divided furnace. The furnace, superheater, and economizer have an automatic, sequential, air-blowing, electrically operated and controlled soot blowing system.

Forced and induced draft fans have hydraulic couplings. Each of two induced draft fans discharges directly to a short stack designed for high velocity in the dispersal of flue gases.

The completely automatic demineralizing water treatment plant consists of two-stage cation and anion units preceded by roughing and polishing filters. Its capacity is adequate for an additional unit.

The turbine is a 138,100-kw, tandem-compound, double-flow unit with 1,800 psig, 1,000F superheat, 1,000F reheat at 1-in. Hg back-pressure with the top heater out of service. A 70,000-sq-ft surface, 100,000-gpm, single-pass, divided-water-box condenser is solidly supported with an expansion joint connection to the turbine.

Two vertical circulating pumps, each having a capacity of 53,000 gpm, supply cooling water to the surface condenser. Water comes through steel pipe under the grade floor and supported on steel beams framed into the H-piling of the foundation.

From the lake, open-cut flumes supply and discharge circulating water. A diversion gate in the discharge flume can divert warmer discharge water through an ice-melting line to the intake flume at the lake. There is an electric fish screen for the intake flume. Chlorine solution is fed to each circulating water pump suction by an automatic chlorination system.

Main hydrogen and oil coolers are supplied with circulating water by 5,000-gpm, vertical, low-head service water pumps, one in each circulating water pump compartment. One pump is a spare.

The evacuating equipment is one single-element, steam-jet air ejector discharging into a motor-driven, single-stage, reciprocating, dry-vacuum pump, and a single-element, two-stage steam-jet air ejector.

Three 60% capacity boiler feed pumps supply feed water to the boiler. The pumps are motor driven. Two have variable-speed hydraulic couplings, and the third is directly connected.

Generator voltage is 15,500. Auxiliaries are supplied at 4,160 and 440 v. Transmission from the station is at 138 kv. Principal design considerations were reliability of operation and economy.

Generator leads are 6,000-amp, isolated-phase, bus-duct type. These extend to the main and unit auxiliary transformers.

The bus enclosure is circular in cross-section and arranged in a series of telescoping sections for easy access to all bus supports. Parts need not be unbolted. Each telescoping section is sealed by an elastic gasket at each end against dust and moisture. There are no longtitudinal joints.

The auxiliary and main transformers are outside the building wall, in line beneath the bus to minimize bends. Generator PT's and lightning arresters are in a cubicle beneath and tapped from the bus just inside the building wall.

FOW Cooling for Main Transformer

The main transformer is rated 140,000 kva FOW. Water cooling was selected because of the availability of clean cool water. The water-cooled design is least costly.

Principal auxiliary motors above 150 hp are supplied at 4,160 rather than 2,300 v because the higher voltage permits the use of less costly switchgear. It also affords a considerable saving in cable, particularly in the main leads from the unit and reserve auxiliary transformers.

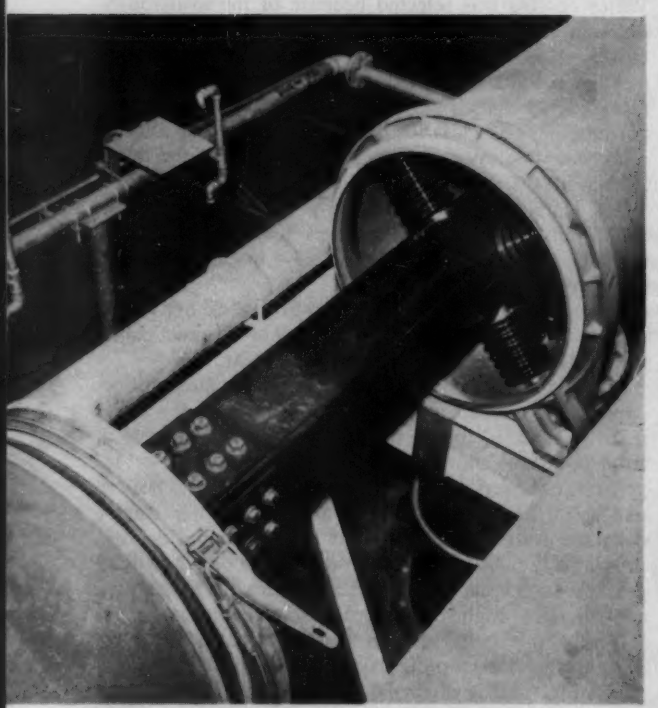
Inside motors up to 150 hp are served at 440 v. Motors in the coal-handling area up to 200 hp are supplied at 440 v. The consideration in each case was economy.

In each area, a 750-kva, 4,160/480-v auxiliary transformer was installed. Use of this size made practicable the lighter and less costly 480-v switchgear.

The 4,160-v switchgear, rated 150 Mva interrupting capacity, is divided into two sections, one on the main floor on each side of the boiler. Each section is served from both unit and reserve auxiliary transformers. In general, each serves auxiliaries on its side of the boiler, and as all essential auxiliaries are furnished in duplicate, the station can be run at reduced capacity, approximately 60% of full-load rating, with either switchgear section out of service. This arrangement contributes to high reliability and short cable runs.

The 440-v switchgear in the power station, rated 15,000 amp interrupting capacity, is arranged as unit substations and is divided into sections located alongside the respective 4,160-v switchgear. One is served from each of the two 4,160-v switchgear sections. The

TELESCOPING BUS DUCT was installed for bringing the generator leads to the transformer outside the generation plant. The circular bus enclosure is arranged in a series of telescoping sections to ease access to the bus supports



SECTION of enclosure is sealed by elastic gasket at end against dust, moisture. There are no longitudinal joints

transformer in each section can serve both sections. Each section has two main breakers, one connected to each transformer, the same as with the 4,160-v switchgear. Askarel-filled transformers were preferred to dry-type to lighten the dust cleaning job.

The 440-v switchgear ratings were selected on the basis that each motor breaker should be able to interrupt a fault on its circuit without depending upon the main breaker for backup. This principle is considered important in designing an auxiliary supply system of high reliability. The main breakers are equipped with direct acting trip devices which trip after a short-time delay on faults and provide selectivity with the feeder breakers, which trip instantaneously on faults.

Each 4,160 and 480-v auxiliary switchgear group in the power station is of dust-tight construction and is kept under a small positive pressure by an individual forced-draft system supplying it with filtered air. The air is sufficient for cooling.

The 4,160-v auxiliary buses are normally connected to the unit auxiliary transformer. On failure of this source, except for bus fault, the circuit is transferred automatically to the reserve auxiliary transformer, served directly from the 138-kv substation. Transfer can be delayed for an adjustable period up to 30 cycles to permit motor residual voltage to die out.

The 440-v auxiliary buses are arranged for automatic transfer without delay.

A special effort was made to keep the noise level to a minimum. Special acoustical treatment was used for all metal walls from the ground floor to the windows above the crane rail. Walls consist of panels with 16-gauge fluted aluminum for the exterior face and 18-gauge steel for the interior face with 2 in. of fiberglass insulation between. The interior sheet of the wall was perforated with ⅛-in. holes on ¼-in. staggered centers with an aluminum foil coating between interior sheet and insulation.

Low Noise Specified for Motors

For all auxiliary motors, minimum practicable sound level was specified with the guarantee not to exceed 90 db. All bidders were requested to state the lowest sound level which they would guarantee, and these figures were considered in evaluation of the bids. In the case of 250-hp motors and larger, manufacturers were asked to make sound-level tests and furnish certified copies of the test reports. Thus motors of modified design were furnished in several instances, the noise levels being probably well below what they would otherwise have been.

Power is supplied for lighting from two unit substations alongside the 4,160 and 480-v switchgear. One is served from each of the two 4,160-v switchgear sections. Each is served by a 300-kva, 4,160-120/208 v, 3-phase transformer. The transformer in each unit substation can serve both, and each section has two main breakers, one connected to each transformer. This arrangement carries out the design established for the 4,160 and 440-v switchgear.

A lighting distribution voltage of 120/208 v, 3-phase was selected in preference to 120/240 single-phase because, with 300-kva transformers, this connection reduces fault currents and permits use of 100-amp, F-frame, molded-case breakers for the outgoing circuits.

SWITCHYARD DESIGN was influenced by the potential dust problem posed by nearby cement plant. Bushings are rated 138 kv extra creep, switch insulators have 161-kv rating, and extra discs have been incorporated into the strain strings

Dual lead-acid 250-v control batteries, duplicate chargers, duplicate dc distribution boards, and duplicate feeds to principal switchgear and control board groups provide a high degree of reliability of this essential service. Each dc board serves an automatic throw-over switch in a lighting substation to provide an emergency source of lighting for essential walkways and control areas.

Most Power Cables Unshielded

All 4,160-v power cable is single-conductor with oil base OZR insulation and chloroprene sheath. It has a 5 kv rating. All except the largest cables are triplexed and unshielded to reduce the complication and space requirements usual for stress cones.

All 440-v power cables are multi-conductor, 600-v Buna-S, heat-resisting, moisture-resisting, rubber-insulated, chloroprene-covered, with an extra $\frac{1}{64}$ in. of sheath thickness as an extra margin of protection to the insulation. Principal control cables are 600-v, multi-conductor, Buna-S, heat-resisting, moisture-resisting, rubber-insulated, with chloroprene sheath, seven strand No. 12 being the smallest size.

Control cables for 115-v ac controls of secondary importance and for instruments, where many conductors are required, are No. 16 polyethylene-insulated with nylon tape over the insulation and polyvinyl chloride sheath. This construction combines small diameter with reliable control cable construction.

Main runs of power and control cables are carried in a system of No. 12-gauge sheet metal pans, 9 in. deep, with widths varying from 1½ ft to 4 ft. These pans are beneath the switchgear groups and control boards, double-decked in some places. Vertical risers and header boxes are placed over control and switchgear groups below the pans. Short conduit runs extend from the pans to individual motors and controls. This arrangement minimizes conduit work.

The pan system is an assembly of standardized units, straight runs, turns, crosses, risers, and offsets to meet approximately 75% of the routing requirements. The remaining special cases, particularly above and below control and switchgear groups, are detailed. The pans are suspended from hangers, and all joints were solidly welded in the field.

Control boards for all main and principal auxiliary equipment, including automatic load-frequency and combustion control, are in one main control room in a bay outside of the turbine room and provided with a separate exit. This location was selected in preference to a central one between boiler and turbine rooms, to provide additional safety to personnel. Boards are arranged as half an octagon to permit quick surveillance of the entire board from a central position.

The main control room, situated against the tem-

(Continued on page 146)

RELATIONS developed for 330-kv dead-tank oil circuit breaker design can be extrapolated for 440-kv and higher service. Ohio Valley system had 1,175-kv BIL insulation with an extra allowance for outside surface contamination

Dead-Tank Oil Circuit Breakers

SUBSTATIONS
Design

Two years' experience with units at 330 kv indicates no reason for changing relations even for lines at 440 kv

A. W. HILL, Manager, Power Circuit Breaker Engineering, Westinghouse Electric Corp, East Pittsburgh, Pa.

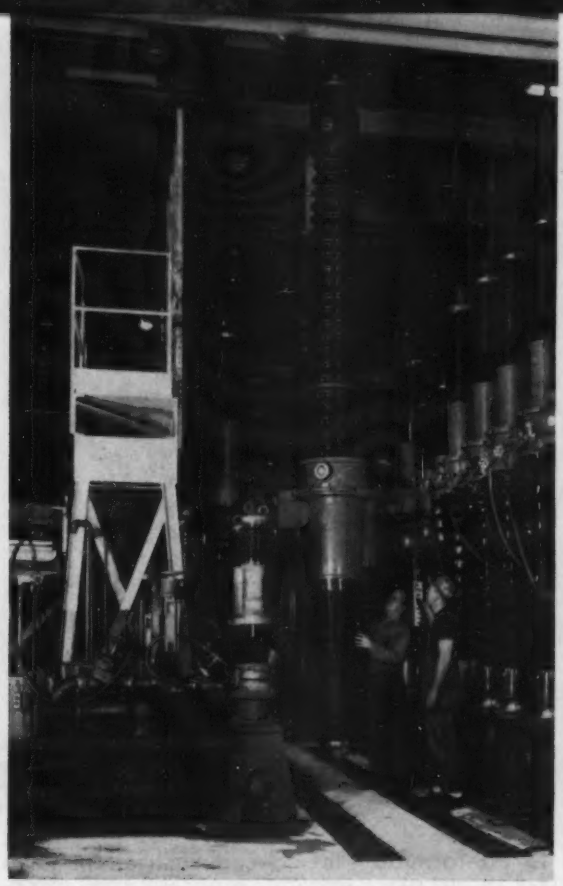
For stability, simplicity and ease of handling, the basic principles of the dead-tank oil circuit breaker have proved most attractive at 330 kv and will, by simple extrapolation, apply equally well at 440 kv or higher. Two year's field experience with 330-kv oil circuit breakers have indicated this clearly.

Designers of the Ohio Valley 330-kv system chose 1,175-kv BIL insulation with some extra allowance for contamination on outside surfaces. Possibly other situations could justify 1,300 BIL and tests on breakers already produced show that this would not be difficult. Experience to date offers no reason for changing the relations established at 330 kv, even for 440 kv.

The condenser-type bushing is built around capacitance sections—"building blocks"—that divide the voltage to ground in equal parts and make most efficient use of the space available. The number of sections can be extended to provide for 440 kv or higher, where we might expect a 1,500-kv BIL. Winding machines now available produce such a bushing core. Porcelain sections for this size have been made and present no great problem. Equipment for evacuating and impregnating such a bushing would need to be enlarged, but that would be simple extrapolation. Laboratory and shop testing are available.

The electrical service record of more than 230 circuit breaker bushings now operating at 330 kv has proved the adequacy of the design. For example, radio influence proved to be scarcely measurable.

Interruption problems looked big when it first became known that 25,000,000 kva was needed in Ohio. This was accentuated by the fact that the available capacity of development laboratories was only approximately one-tenth of this value. To overcome this apparent deficiency, multi-break interrupters were developed which could be verified adequately by the unit test method. Short circuit performance in the field under storm conditions has confirmed the reliability of these test methods. And staged tests, dropping lines of 40 to 180 miles,



SERVICE RECORD on 230 bushings for 330-kv oil circuit breakers shows 100% performance with low radio influence

HEAVY LIFTING during breaker maintenance is eliminated by easy accessibility to the interrupters and to bushing CTs

Proved for 330 Kv and Higher

duplicated exactly the re-strike-free performance in the laboratory.

An important part of the predictable performance at 330 kv, or at 440 kv and higher with added units, can be attributed to the arrangement of resistors and capacitors that assures equal division of voltage across the interrupters. Resistors assure equal division of recovery voltages, and capacitors reduce maximum gradients on the insulation under surge conditions.

Temperature tests have demonstrated that because of the large masses and radiating surfaces, 2,000-amp ratings are entirely feasible with present temperature-rise considerations.

Mechanical integrity is a most important consideration. The 330-kv breaker fell into the accepted pattern of past designs because it provided for simple initial adjustment plus ease of later inspection and maintenance. The policy of using only one operating mechanism for all three poles proved sound in that consistent closing and opening time was obtained in all phases. Instantaneous (20 cycle) reclosure requirement is met easily. Interrupting time is less than 3 cycles, even for light currents during load or line-charging conditions.

Power Needs Reasonable

Power requirements of a single mechanism were reasonable at 330 kv, and with a minor increase, would handle an added interrupter per stack at 440 kv.

Maintenance is recognized as one problem where design ingenuity can do much to bring favorable comment. Facilities for handling the larger interrupters and bushing current transformers inside the tank can be provided easily to eliminate all heavy lifting by the maintenance crew. Light platforms can be attached to the tanks to enable the crew to work safely. Ease of removing the interrupter blocks in present 330-kv breakers facilitates a quick check of their condition and of the contact surfaces without affecting the mechanical alignment. In fact, contact closing and operation can be observed directly within a few minutes after entering the tank.

While these 330-kv units were the largest breakers ever built, their manufacture, shipment, and erection were handled easily with existing facilities. Tanks for 440 kv can be produced with available fabricating facilities and are easily within limits of railroad clearances. At these higher voltages, breaker pole spacing is determined by electrical clearances in air, rather than by physical design limitation in the breaker.

Installation time is less than a week for a 330-kv breaker. Complete inspection, including change of oil, takes less than a day.

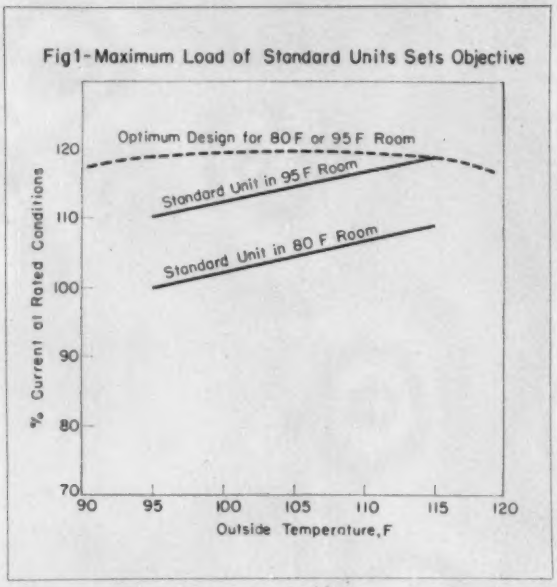


Fig 1 - Maximum Load of Standard Units Sets Objective

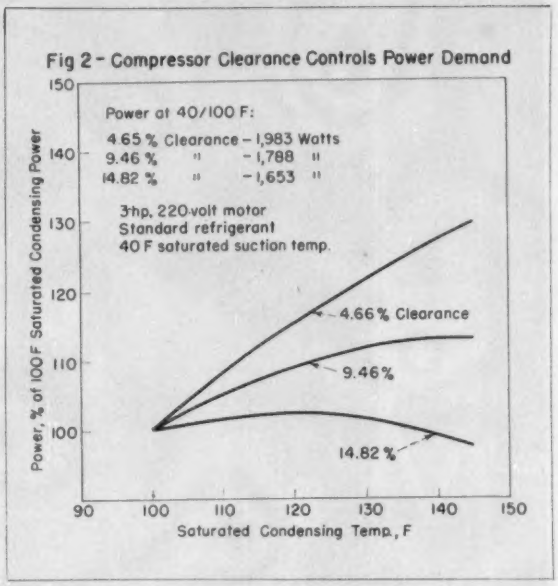


Fig 2 - Compressor Clearance Controls Power Demand

Redesigned Refrigerant System

DISTRIBUTION
Operation

Modification to conform to NEC circuit restrictions also provides improved cooling characteristics of room units

WILLIAM L. McGRATH, Chief Engineer, Unitary Equipment Division, Carrier Corp, Syracuse, N. Y.

Re-designing the refrigerant flow system of an air-cooled, packaged, room-type air conditioner minimizes the differences among starting, maximum demand, and running currents which today plague users, manufacturers and utilities. Furthermore, it is quite feasible to increase cooling capacity as much as 15 to 20% for the same installed kva.

For many years dwellings have been wired with No. 14 conductors with 15-amp receptacles for 15-amp fuses. But last year an interim amendment to the National Electrical Code, in effect, classified air-conditioning units as "fixed" appliances, not to draw more than 50% of the capacity of the multi-outlet branch circuit. Thus the permissible nameplate current of air-conditioning units, designed to be plugged into multi-outlet 15-amp circuits, was cut to 7½ amp.

Another provision of the NEC permits the installation of fixed appliances, including air-conditioning units, on single-outlet branch circuits to 80% of the rating. When there is only a single outlet on the 15-amp circuit, an air conditioner with a full-load rating of 12 amp may be installed. The effect of these provisions is to fix two sizes; one of 7½ amp for multi-outlet, and another of 12 amp for single-outlet branch circuits.

The nameplate current of an air-conditioning unit is determined in the process of testing and listing by the Underwriters Laboratories as the current drawn during operation from start up (also "pull down") in a hot room. This test condition is 104F dry bulb inside and outside. A so-called "full load" marking is then taken at 85% of the value found under this extreme condition.

Starting Dips Reduced

Momentary voltage dips on lighting circuits when motor-operated appliances are started has long been a nuisance. The instantaneous starting current of conventional open-motor equipment may be five or six times normal full-load current. When such current has sufficient duration, momentary dimming of lights or unwanted effects on TV may cause annoyance.

Such problems are much less severe with hermetic refrigeration compressors. This is due in part to the low inertia of such motor-compressor combinations which enables them to reach running speed within a few cycles. A joint industry committee has prepared a code limiting the starting (locked-rotor) current on 115-v circuits to 23 amp when the combination is controlled automatically, and to 46 amp where controlled manually. Air conditioning units of this type, because of infrequent starting and stopping, are generally considered in the manual-control category. Actually such machines run almost continuously at the time of the circuits' heaviest loads.

Electric utilities are also concerned about the impact of air-conditioning load on distribution systems, transformers, and even generating capacity. Provisions for

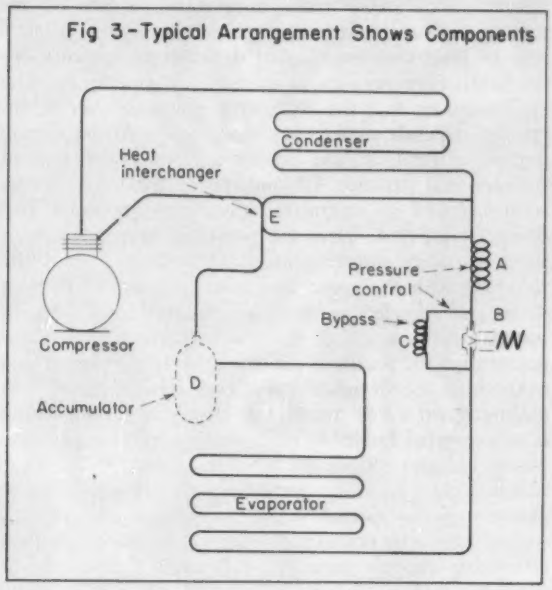


Fig 3-Typical Arrangement Shows Components

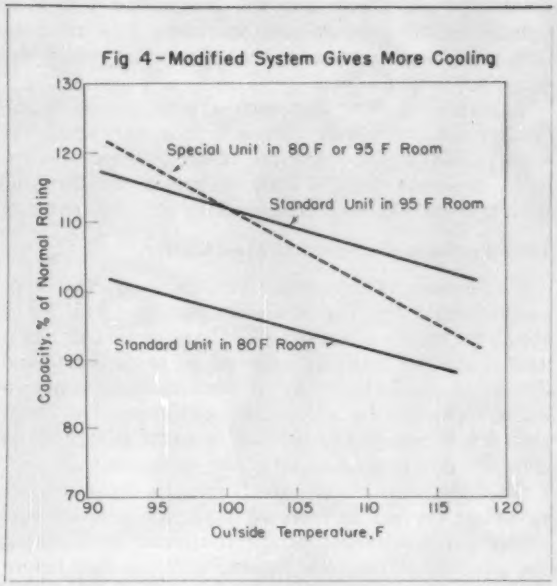


Fig 4-Modified System Gives More Cooling

Cuts Air-Conditioner Demand

these may be inconsistent with the revenue to be expected. This problem is intensified where summer load makes the peak on the system.

Efforts have been made to reduce installed kva requirements of air-conditioning equipment by increasing its power factor. Perhaps the most important objective, from an equipment design standpoint, is reduction of amp (or installed kva) per ton of refrigeration.

Most manufacturers of room air conditioners this year will offer low-ampere models in which 7½-amp, 115-v and 12-amp, 115-v will be established as commercial sizes. Ampere demands have been reduced 15 to 25% by using relatively large amounts of capacitance on the compressor motor circuit and by adopting capacitor-type fan motors in place of the shaded-pole type. This method is most effective on smaller units. Larger single-phase equipment already had rather large running capacitors for other reasons. Reduction in running amperes has been accomplished almost entirely by improvement of power factor with little effect on instantaneous starting currents.

Current reduction through improved power factor and the like is not enough to cut the running current of the so-called "¾" unit to 7½ amp from the former 12-to-15-amp level. The rest of the recovery must come from reduction of capacity.

Air-conditioning units are purchased usually for cooling under operating conditions of 75 to 80F inside and 95 to 100F outside. This represents performance normally expected, but the unit must remain operative when called upon to start and run in a hot room with the sun beating on the exterior of the conditioner. When thus started, operation must continue until the room temperature is pulled down to normal. An industry standard for this duty calls for ability to operate under test at 95F (dry bulb), 75F (wet bulb) inside and 115F (dry bulb), 80F (wet bulb) outside. Underwriters Laboratories also simulate maximum pull down at 104F inside and 104F outside.

The current drawn by a typical conventional air-cooled compressor in air-conditioning duty is illustrated in Fig. 1. Pull-down current may be 20% or more above rated operation. Were it possible to preclude a rise in current above the rated condition, substantially more capacity could be obtained for the same maximum current. This is illustrated by the dashed line on the chart. Such a system would draw no more current during pull down than for normal conditions, thus permitting an increase in the size of the compressor and system, thereby obtaining more cooling capacity.

Constant Gas Density Cuts Power Peaks

This is accomplished by holding the gas density constant as room temperature goes from 75 to 95F at pull down. An expansion device sensitive to suction pressure or saturated suction temperature is used to throttle the flow of refrigerant as its pressure tends to rise.

With the pressure and density of the gas held constant, power requirements would be constant, provided the product of effective displacement and head in the compressor can be held constant too. This requirement calls for a compressor whose effective stroke is reduced inversely with the polytropic head against which it works. It can be achieved by building the compressor so that its return stroke is assisted by expansion of the high-pressure gas trapped in the clearance volume. Under the high head pressure of pull down, such a compressor would have the same gas volume trapped in its clearance space but under substantially higher pressure and density. The effective stroke and, therefore, the

volume of gas drawn into the compressor would be reduced as the pressure ratio increases. This relationship is precisely inverse so that a constant power demand will apply.

Experiments show that such a modification of the compressor causes little change in efficiency under the same conditions of operation. Over a range of 4-to-14% clearance there is little change in the Btu/whr performance. In some cases it may actually improve.

Tests Evaluate Compressor Modification

Calculations of the critical clearance value must be supplemented with experimental determinations. Fig 2 shows the results of tests at a constant suction temperature of 40F for three different values of clearance and the power requirements for various saturated condensing temperatures for a common refrigerant. The clearance value required to provide constant power varies considerably, depending upon the refrigerant.

To make such a system workable, an expansion device must prevent an increase in suction pressure and refrigerant density but permit refrigerant flow during the off cycle so that the system may equalize before the next start.

Fig 3 shows a typical schematic arrangement in which restriction A controls refrigerant flow when the valve is open, valve B throttles the flow when the suction pressure tends to rise above the balance point at rated conditions, and restriction C permits a reduced flow of refrigerant when the valve is closed. This restriction limits control range of the pressure-responsive valve to that portion required to keep suction pressure down to rated value and also permits the system to equalize during periods when the machine is shut down.

Accumulator D assists in control of the system, particularly under light loads and a suction. Liquid interchanger E will prove beneficial to performance with some refrigerants.

An incidental advantage of the pressure responsive valve is that the restrictor must no longer be selected for several conflicting requirements. With overloading eliminated, the combination of restrictors and valve can be selected to prevent frosting of the evaporator under extremely low load conditions to permit greater control of capacity with better dehumidification and less frequent cycling of the compressor. In addition it causes current drawn by the compressor to drop slightly as the outside temperature and head pressure rise even higher than the pull-down condition. This is of substantial advantage in areas where temporary periods of extremely high ambient temperatures may occur. It tends also to limit overstressing of distribution systems under temporary periods of excessive temperature. The exact amount that the Btu per hr capacity can be increased depends somewhat on the design of the system but, in general, should be 15 to 20% over that of conventional practice. Obviously, the margin is somewhat reduced as operating conditions approach pull down as in Fig 4. Here the proposed unit will have a rated capacity approximately 18% higher than the standard with the same maximum current under pull down. As outside temperature rises to 115F, the proposed system will still have a somewhat higher capacity than the standard one because the condenser and evaporator are designed for higher basic capacity. In pulling down a 95F room, the proposed system would take somewhat longer to drop the dry-bulb temperature but would also reduce the humidity factor.

Even more startling reductions in current requirements may be gained when the system described is supplemented by power-factor improvement, 24-hr load estimating (taking account of thermal inertia), 24-hr capacity ratings (taking advantage of the capacity improvement from cycle daily temperature variations), and reduced condensing temperatures in design.

Continuous Operation Permits Smaller Unit

Considerable field research has gone into the effect of periodic or cyclic variations on building load. Air-conditioning equipment operating 24 hrs a day under thermostatic control will maintain design conditions inside with equipment 40 to 50% smaller than that indicated by instantaneous-load estimates and perhaps 10 to 20% smaller than by conventional-load estimates which reflect some reduction in sun peak load.

Even further reduction would be possible were owners of air conditioning talked into a temperature reduction at night similar to the night setback used on heating plants. Such a night temperature reduction would provide storage in the structure and furnishings and allow for a gradual rise in temperature during the day without exceeding the desired inside temperature.

Another saving on installed plant capacity is possible where air cooled equipment is operated 24 hrs a day. Again, because storage of the structure irons out differences from hour to hour, more capacity will be available from the cooling plant than is apparent by inspecting its rating at maximum outside temperature. In most areas, based on a 20F daily range in outside temperatures, plant size can be cut 5 to 7%.

The tabulation illustrates what could be achieved by pyramiding the various methods of load reduction. An instantaneous estimate with motors and auxiliaries of a conventional nature (0.75 pf) for the 32,700-Btu load might require 4.9 installed kva. Estimating by the form recommended by ARI, cuts the load to 29,000 Btu/hr and the installed kva to 4.2. The system described in this paper will reduce installed kva approximately 15% and still maintain the same 29,000 Btu/hr capacity with 3.6 kva. Basing the estimate on 24-hr operation will reduce the requirement to 19,300 Btu/hr and cut the installed kva another 33%. And applying the equipment rating on the basis of 24-hr operation cuts the size of the plant another 7% to 2.25 kva.

24-Hr Operation Cuts Air Conditioning Loads

Btu/hr Estimates	Instantaneous	ARI	24-Hr Operation
Windows (Solar gain)	8,770	4,160	6,600
Windows (Transmission)	4,700	5,200	
Walls (Solar & trans. gain)	2,850	4,160	1,880
Roof (Solar & trans. gain)	4,060	4,000	2,000
Outside Air	2,880	3,000	.....
Cooking	.....	.....	1,200
People	1,230	1,000	1,500
Blower Motor & Duct Heat Gain	3,680	800	1,200
Total Sensible Heat	28,170	22,320	14,380
Total Latent Heat	4,530	6,700	4,820
Grand Total Heat	32,700	29,020	19,200

GENERAL ELECTRIC ML-32 STEP VOLTAGE REGULATORS on the line at the substation of a large midwestern utility.

Midwest Utility Finds That General Electric ML-32 Voltage Regulators Require

"PRACTICALLY NO MAINTENANCE"

By Bob Bry, Manager—Marketing Voltage Regulator Product Section

A large midwest electric utility has been installing a great many of our ML-32 step voltage regulators. We asked them why, and here is what they told us:

One of their Division Superintendents said: "I like the ML-32 from the maintenance point of view. There is practically no maintenance as compared with other types or makes of regulation. I feel we save time and money because it isn't as necessary to continually check the G-E regulators."

He feels that big dollar savings have resulted for his company because "installation of the G-E regulators has cut down on the number of maintenance trips we've had to make to outlying areas and the oil field sections."

Another reason for this utility's preference for ML-32 regulators is the G-E Load Bonus which allows them to increase current capacity while the regulator is energized.

Another one of their Division Superintendents put it this way: "I especially like the ML-32's Load Bonus feature because, in cases where the load builds up and exceeds the regulator rating, we can use Load Bonus to obtain a capacity of 160%. In other words, in cases where the load builds up, we set the taps up on the transformer and set the regulator to boost 5% and buck 10%."

Reduced maintenance costs and increased current capacity can save your company money, too. Learn more about this new G-E regulator by asking your G-E representative or by writing Section 423-22, General Electric Co., Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

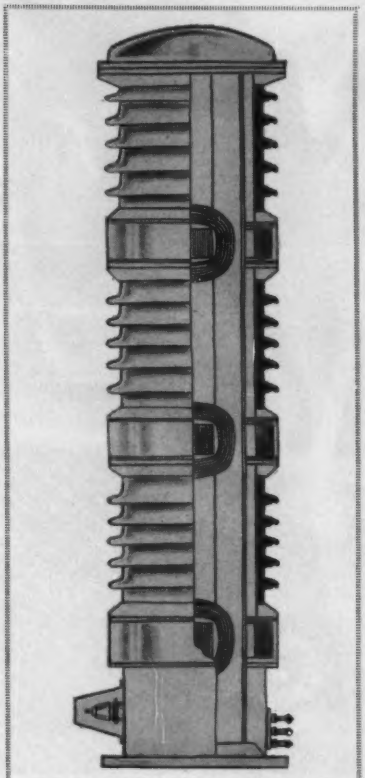


FIG 1—CASCADE TRANSFORMER

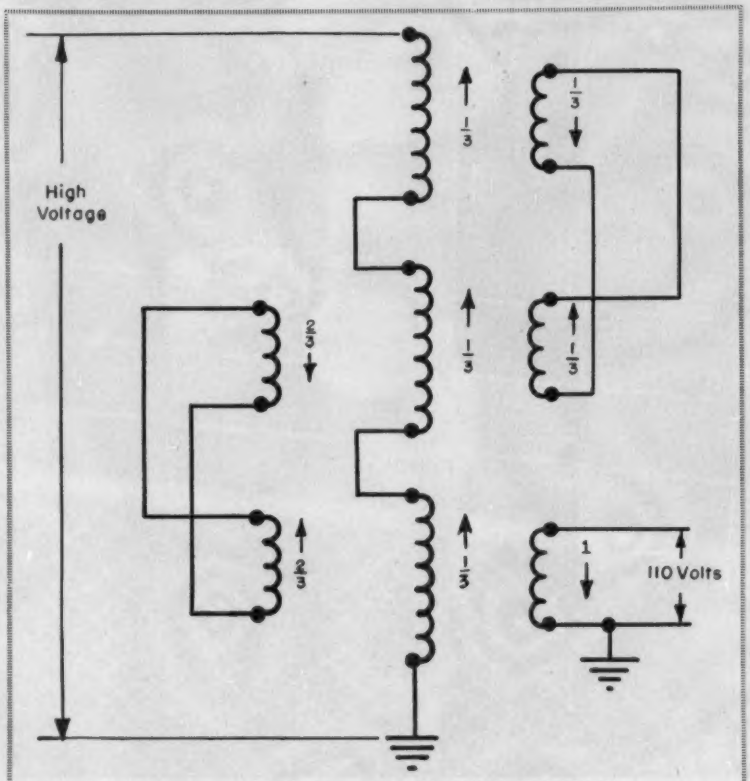


FIG 2—CASCADE ARRANGEMENT HAS COUPLING WINDINGS

TODAY'S DESIGN TRENDS

Cascading Saves on Potential Transformers

G. CAMILLI, Transformer Development Eng'r, General Electric Co, Pittsfield, Mass.

A potential transformer with cascaded windings offers the utility industry new equipment which, not only costs less than the conventional transformer for circuits 115 kv and above, but has excellent accuracy and burden capability. It consists of several units in series.

This transformer has been designed to afford the benefits of the conventional pot. But the high cost of such pots has prompted the industry to substitute for them a large number of bushing potential devices, despite the latters' limitations on accuracy and burden. The new design is expected to replace both the older conventional, single-bushing pots and bushing potential devices in some applications. It is available at a cost about 45% less than the conventional single-bushing pot.

Increase in Direct Ratio

Potential transformers are not for the transfer of substantial quantities of power. Accordingly, their iron and steel are a low percentage of total cost. Major cost components are insulation, case, bushings, and oil. The conventional pot's insulation and most of its other materials increase approximately as the square of voltage. In the cascade arrangement material increases are in only direct ratio to the rise in voltage.

Insulation improvements, for instance, materially affect the size and, consequently, the price. As insulating distances at best are directly proportional to voltage, doubling the voltage could produce an eightfold change in insulation volume which varies as the cube of the distance.

In the cascade transformer total voltage is divided into several steps, and each step has its proper insulation. Small low-voltage units are connected in series or cascade, their number and bulk dictated by economics and accuracy requirements. Thus the cascade unit weighs about half as much as the conventional type and is approximately ⅗ as high.

In the cascade for 115 kv, each

(Continued on page 86)

Unmasking a safe ground

Capacitors should be grounded to make them safe. Ask any lineman who has brushed against ungrounded equipment 25 feet up a pole—he'll tell you!

General Electric solves the problem of positively grounding 50-kvar capacitors by a simple step in finishing. The mounting hole area is masked during painting and the mask stripped off afterwards to leave clean, unpainted metal on the bottom of the bracket. The capacitor practically grounds itself as soon as it is mounted in a rack.

The ground is permanent, too. Corrosion won't foul the metal-to-metal contact.

Want to know more? Your G-E Apparatus Sales Engineer will welcome your capacitor questions. Or write to General Electric, Section 445-3, Schenectady 5, New York.

Progress Is Our Most Important Product

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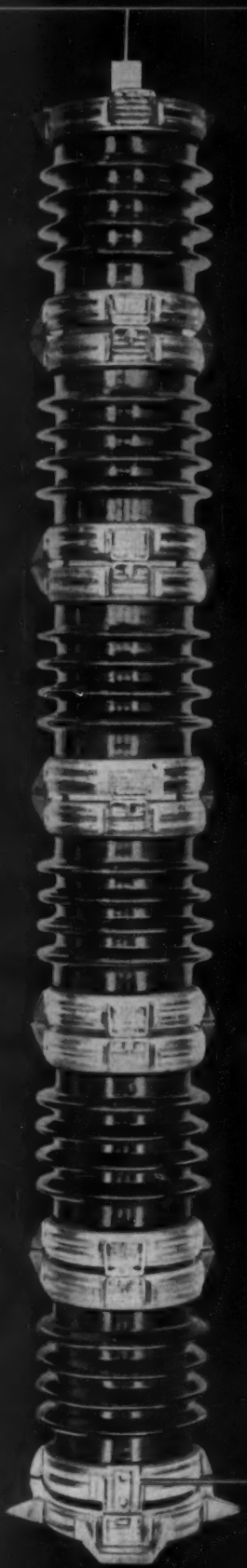
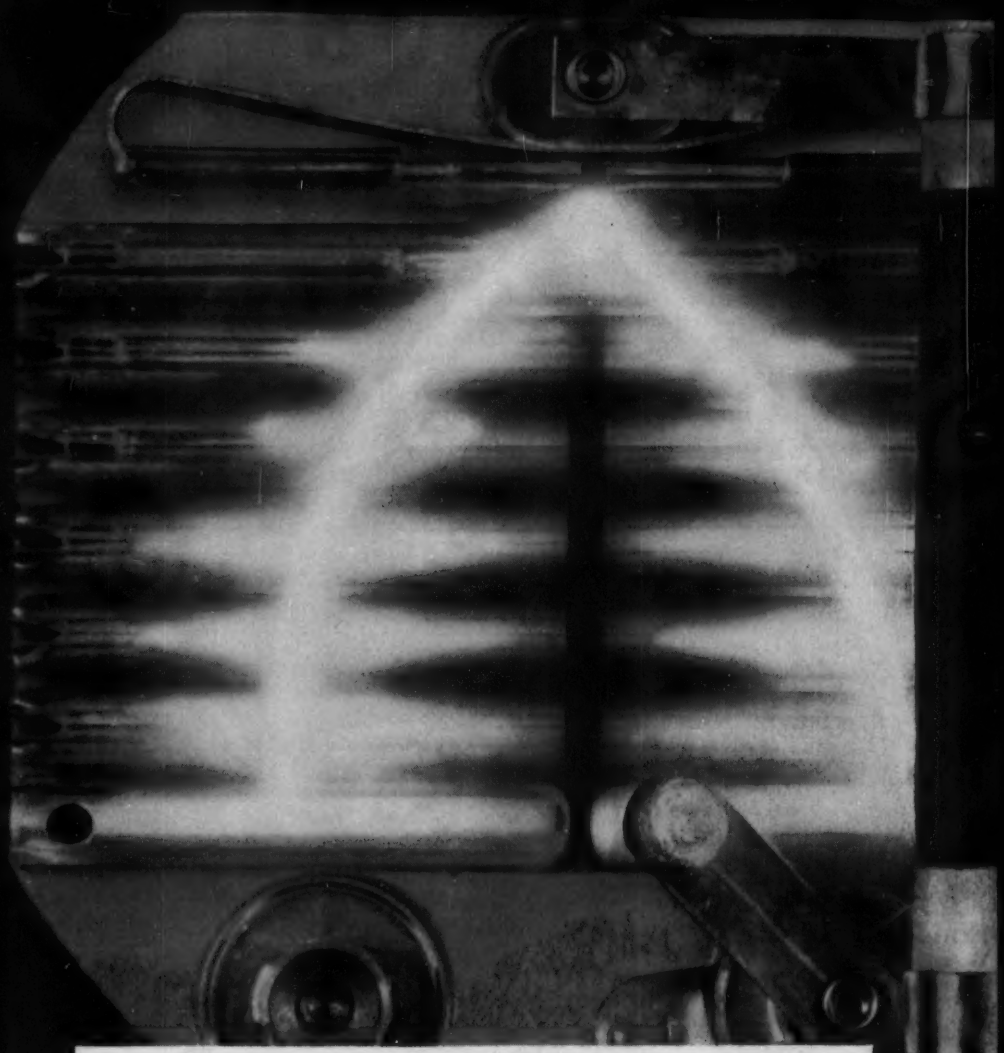




STAIRWAY TO OBLIVION

Magne-valve Station-type Arresters use the magnetic force produced by coils placed above and below the interrupting gaps to sweep the power follow-current arc to extinction in less than a half cycle. Arc moves progressively from main gap to as many as 14 gaps in series. This picture, from a high-speed movie taken at 4000 frames per second, shows the arc just prior to interruption.

Proved Magne-valve principle gives

3 TIMES GREATER DISCHARGE CAPACITY

with General Electric Station Arresters

You get over 3 times greater long duration discharge capacity with General Electric station-type lightning arresters. You also get their ability to handle direct stroke currents as high as 150,000 amperes (5 x 10 μs wave). There's plenty of thermal endurance to withstand multiple strokes and severe switching surges. Available ratings cover all system voltage requirements from 3 to 345-kv.

High protective efficiency is made possible by the General Electric Magne-valve principle first developed by G-E engineers in the mid-1940's. This principle combines the valve action of greatly improved Thyrite* disks with the unique magnetic action of series gaps shown on the opposite page.

Magne-valve has revolutionized many important aspects of equipment design and application. It made possible reduced insulation two steps below "Full B.I.L." for power transformers rated 138-kv and above, with resultant large savings in apparatus investment. It greatly liberalizes the permissible separation between the arrester and apparatus, and gives an *extra* margin of protection for unshielded, or inadequately shielded, equipment. It also extends the life of older apparatus having subnormal insulation.

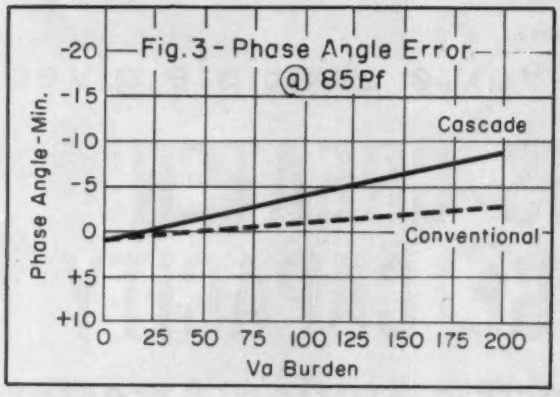
The new Magne-valve Station-type Arresters represent the most significant advance in lightning protection since General Electric first introduced arresters utilizing Thyrite over 25 years ago. For complete information on what these new arresters can mean to you, get in touch with your nearest G-E Apparatus Sales Office, or write for Bulletin GEA-1304 to General Electric Company, Section 432-22, Schenectady 5, New York.

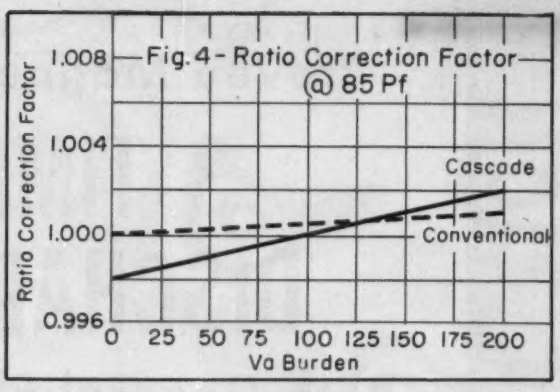
*Reg. trade-mark of General Electric Co. for molded resistance material.

Magne-valve arresters for every application R. W. Frahm, Manager of Marketing—Lightning Arrester and Cutout Section, displays representative samples of the complete Magne-valve line.

Progress Is Our Most Important Product

GENERAL ELECTRIC





Cascading Saves

(Continued from page 82)

of three stages or units is designed for a third of the system voltage. Each core with its coils is contained in a steel section separated by porcelain shells. The oil is common throughout the stack, and expansion space is provided at the top. The usual clamping-ring construction is cemented at the ends of the porcelains. The primary terminal is at the top, and at the bottom is an enclosure for the low-voltage terminals. There is a bushing for the grounded end of the high-voltage neutral.

Coupling Windings Used

Essential to the arrangement's satisfactory operation are coupling windings which force equal division of voltage among the units and affords a low-impedance path for load current.

Although the accuracy performance of the cascade is not quite as good as that of the conventional transformer, it remains well within ASA 3/10 limits with regard to ratio and phase angle. It also meets the ASA standard impulse strength levels with ample safety margins and has at least 4 kva of thermal capacity. Like the conventional pot, it is capable of withstanding full line-to-line voltage under line-fault conditions.

GENERATION—Maintenance

Heat and Cold Team to Put Rotor on Shaft

Dry ice and electric heat teamed up to help shrink rotors on shafts at two Pacific Gas & Electric Co hydro stations.

At Stanislaus River Powerhouse, a 5-ton Pelton wheel was replaced after 35 years of service. At room temperature, the shaft diameter exceeded Pelton wheel hub ID by 7 mils. 1500 lb of dry ice were packed around the shaft for 6 hr while electric strip heaters raised the temperature of the wheel hub. Result was that shaft diameter had contracted 13 mils and hub ID had expanded 30 mils, giving slip tolerance of 36 mils. The wheel was placed accurately on the shaft, and an excellent shrink-fit was obtained. Replacement of two generating unit rotors at Electra Powerhouse on the Mokelumne River was affected also by this technique.

(More How To on page 88)

transformers

EASY TO INSTALL

Light, compact design makes handling easy.

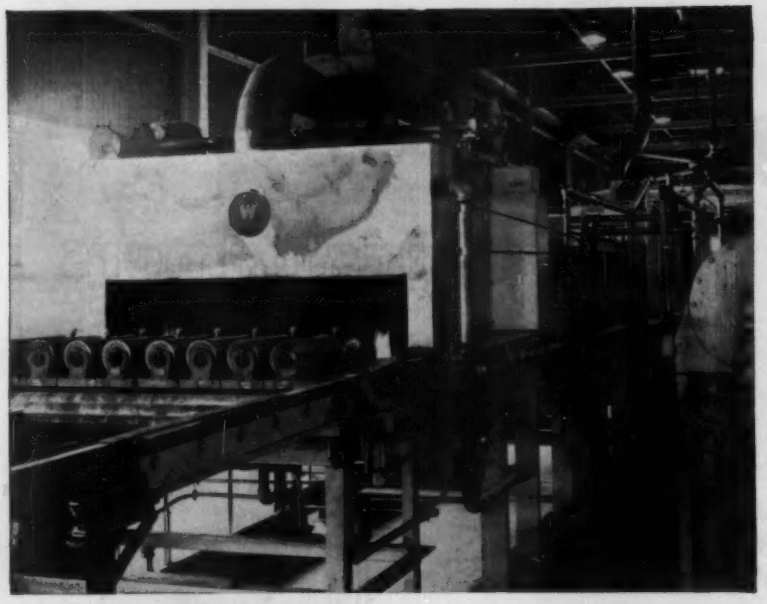
- **Standard EEI-NEMA mounting brackets.** Upper bracket on tank has jump proof lug.
- **Both high and low voltage bushing terminals will accommodate either copper or aluminum conductor** in full range of sizes required by NEMA Standards.
- **Ground connector can be rotated** to provide three possible ground wire entrances.
- **Locked type secondary bushings** provide safe, speedy hookups.

EASY TO MAINTAIN

R T & E's new transformers are loaded with features to minimize maintenance.

- **Externally operated tap changer** eliminates entering tank; handle is marked for easy identification of tap position. Taps can be changed readily without disturbing transformer seals.
- **Terminal failures due to stress corrosion are minimized** by use of special aluminum bronze alloy terminals.
- **Band type cover clamp** and tank cover can be removed as a single unit.
- **Completely "Weather Protected" to resist corrosion** by three coats of baked on modified alkyd paint, arc welded seams, stainless steel band type cover clamp and stainless steel mounting pads.
- **Inhibited Oil—(D.B.P.C.) effectively increases transformer life** up to 15 times by reducing sludging.
- **Locked type secondary bushings** will not turn when line leads are attached thus maintaining tight gasket seal.

equipment to help provide power for America R T & E CORPORATION
WAUKESHA, WISCONSIN

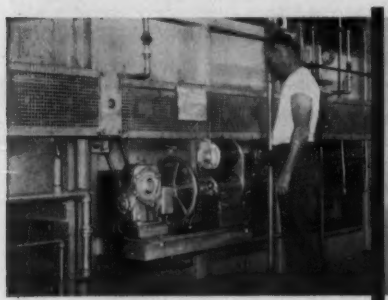


How does ONAN Emergency Electricity protect this electric roller hearth furnace?

This furnace operates at 1400° F. Inside are a series of steel rollers driven by an electric motor, which turn at low speed and move pallets loaded with metal parts through the furnace. If these rollers should stop turning for as short a period as 5 minutes . . . deformation will occur and the rollers must be replaced. This is a very costly repair.

To guard against this loss and to keep the furnace operating, the company installed an Onan 3,500-watt emergency electric plant with completely automatic controls. Now . . . if regular service is interrupted, the plant starts automatically and takes over the power load. It keeps the three ½ H.P. electric motors running and supplies 1,000 watts for emergency lighting.

Where an industrial process cannot be interrupted without serious loss . . . an Onan Emergency Electric Plant may pay its entire cost several times a year. Ask your consulting engineer, or electrical contractor about Onan Standby Power . . . or write us for information.



This is one of the electric motors on the emergency power circuit. Power is transmitted through the gear reducer in the foreground to drive furnace rollers at very low speed.

The Onan 3,500-watt emergency plant is installed in the plant 300 feet from the furnace. Automatic start and stop control is located near the furnace.

WRITE FOR FOLDER ON EMERGENCY POWER

Onan ELECTRIC PLANTS

D. W. ONAN & SONS INC.

2975 UNIVERSITY AVENUE S.E., MINNEAPOLIS 14, MINNESOTA

LOAD HOLDING DEVICE is mounted on the top of the rotating standard.

Holds Load In Demand Meter Test

W. T. SCHUETZ, Supervisor, Technical Section, Electric Meter Department, Cincinnati Gas & Electric Co, Cincinnati, Ohio

To meet the need for a lightweight, portable, accurate means of testing the demand section of 5-amp transformer-type thermal demand meters on customers' premises, a load-holding device was designed for use in conjunction with the rotating standard.

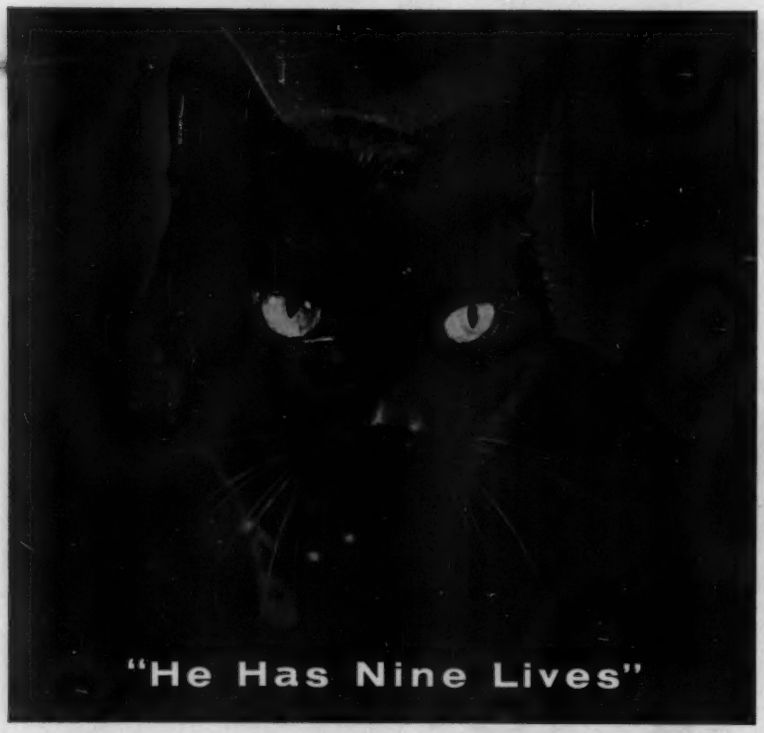
The device consists of a red rotating pointer mounted between two plates of lucite and driven at 6 rpm by a synchronous motor. The rotating pointer was obtained by cutting out the center of a large flat gear and inserting a piece of lucite on which the pointer was painted.

In operation the 5-amp load current to the meter is passed through the rotating standard coil having a disk constant of 5/3 at 120 v. The device is set on top of the rotating standard, and the two pointers are kept in synchronism by varying the load, so that a constant 600-w load is maintained on the meter.

This has proved to be a very accurate method of holding a constant load. Accuracy is assured by the high accuracy of a rotating standard and because any small vari-

(Continued on page 90)

new! always RIGHT FOR ANY BI-METAL OR Al TO Al CONNECTION
WEAVER
PARALLEL GROOVE CLAMPS
ni-cad* COATED!
The weatherproof NICAD coating (over a hi-strength aluminum body) keeps any bi-metal connection troublefree, come what may: Heat, cold, salt, alkali, you name it!
They eliminate trouble caused by... (1) Oxidation of Cu against Al; (2) Unequal expansion or contraction of lines and clamps during severe temperature changes. Contacts stay tight—no arcs.
NO SEPARATE INSERTS TO CATCH MOISTURE AND CAUSE CORROSION! NO SOLDERED JOINTS!
Permanent Low-Resistance Connections
WRITE FOR SAMPLES FOR TESTING
Five sizes now available (NI-CAD coated or non-coated) to cover all requirements.
* Extremely heavy coating of cadmium and other corrosion resistant elements
2110 HOWARD ST. • ST. LOUIS 6, MO. • CEntral 1-8100
J. A. WEAVER Company



..but for long collector life

THE AEROTEC NEW 5 RWS

Aerotec's latest development in the field of erosion resistant dust collector tubes is unique.

Aerotec engineers proved, by accelerated tests under erosive conditions many times greater than normally encountered, that of all metals tested, white cast iron assures maximum resistance to abrasion.

These tests are substantiated by actual installations. They now establish the Aerotec 5 RWS collector with white iron tubes as the ultimate in long life and sustained high efficiency in the field of mechanical collection.

If your dust collection problem requires top mechanical efficiency, discover the assurance of highest performance and long life possible only with an Aerotec 5 RWS. Call or write our Project Engineers today. They are ready to help you solve your dust control problem.

Project Engineers THE THERMIX CORPORATION Greenwich, Conn.
(Offices in 38 principal cities)
Canadian Affiliates: T. C. CHOWN, LTD., 1440 S. Catherine St. W., Montreal, Que.
Manufacturers
THE AEROTEC CORPORATION
Greenwich, Conn.

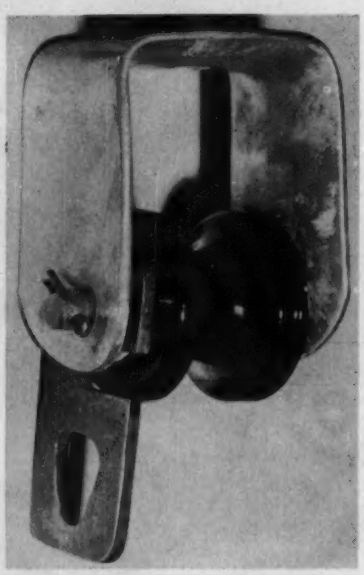
Holds Load

(Continued from page 88)

ation in load which the operator may permit is automatically averaged to 600 w as soon as the operator brings the pointer into synchronism again.

The previous method of determining wattage of the load from the registration on the rotating standard commonly showed apparent errors in the thermal demand section of several percent, caused by variations in line voltage. With the new device, premise tests on 81 meters, which had been previously tested in the shop, found the errors not to exceed 1% on 78 meters or 96% of those tested.

DISTRIBUTION—Construction



Pulling of Secondaries Aided by Block Support

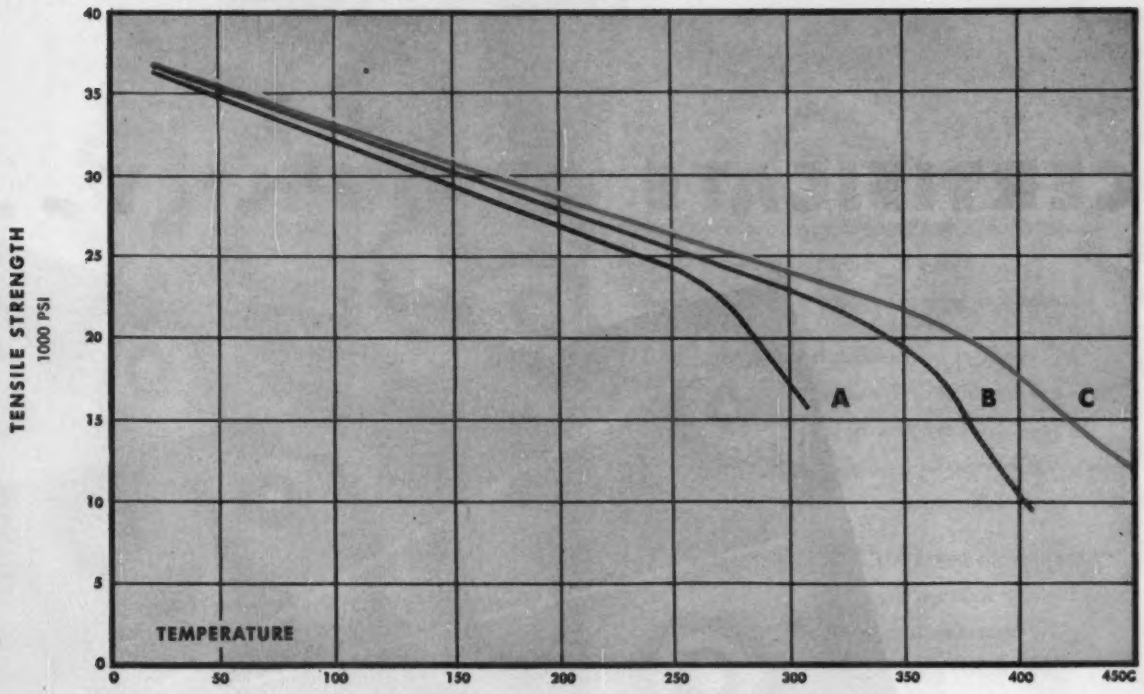
CLYDE WYSOR, Appalachian Electric Power Co, Bluefield, W. Va.

A slotted block support, made from a 4x5x¼-in. piece of scrap steel, eases the job of Appalachian Electric Power Co linemen in pulling secondary conductors in this division.

Formerly, linemen attached the standing end of the blocks to a sling

(Continued on page 94)

How silver helps copper conductors at elevated temperatures



THE INFLUENCE of silver on the tensile properties of high-conductivity copper at elevated temperatures. Tests made by the Metallurgical Research Laboratory of The American Brass Company. The test pieces were copper strips, cold-rolled to a temper approximately that of hard-drawn rectangular bus bar.
A. Electrolytic copper, silver content normal
B. Electrolytic copper, silver 8.7 ounces per ton added
C. Electrolytic copper, silver 28 ounces per ton added

In heavily loaded motors and generators, the windings, collector rings, and commutators must retain their strength at the higher operating temperatures that have become the rule. And there are now many other places where copper conductors must operate at temperatures well above those heretofore considered normal.

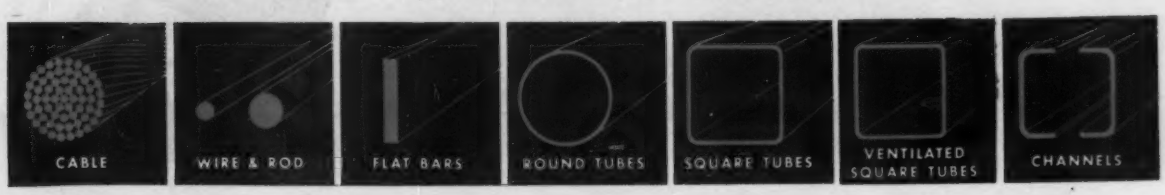
Electrolytic copper—with a very small amount of silver added—is superior to any other commercial conductor metal for use at these higher temperatures. Anaconda silver-bearing copper retains the structural design strength of the conductor at the higher operating temperatures. Annealing temperature is raised and softening delayed. The margin of safety is improved. How much gain you can count on is indicated by the chart above.

More complete information is available in the brand-new Fifth Edition of The American Brass Company's Publication C-25, "Anaconda Copper for Electrical Conductors." In addition, this 62-page booklet has convenient new tables giving physical and electrical data on all types of rigid bus conductors for the most commonly used sizes—plus a wealth of general information on the properties of copper conductors.

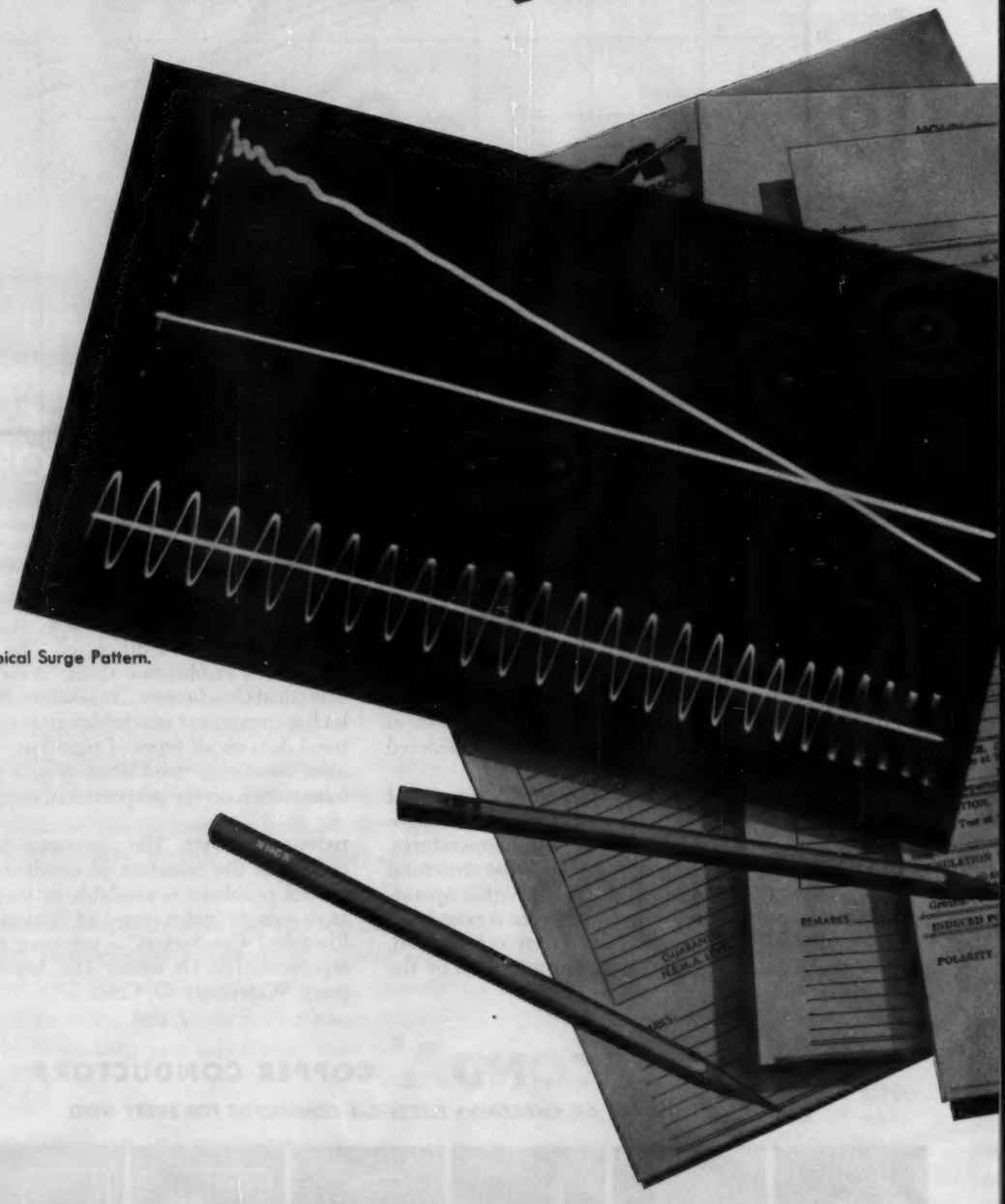
TECHNICAL SERVICE. The assistance of Anaconda specialists in the selection of conductors to meet your special problems is available to you. For such assistance—or to get a copy of "Anaconda Copper for Electrical Conductors"—see your nearby Anaconda representative. Or write: The American Brass Company, Waterbury 20, Conn. 84100

ANACONDA® COPPER CONDUCTORS

THERE'S AN ANACONDA ELECTRICAL CONDUCTOR FOR EVERY NEED

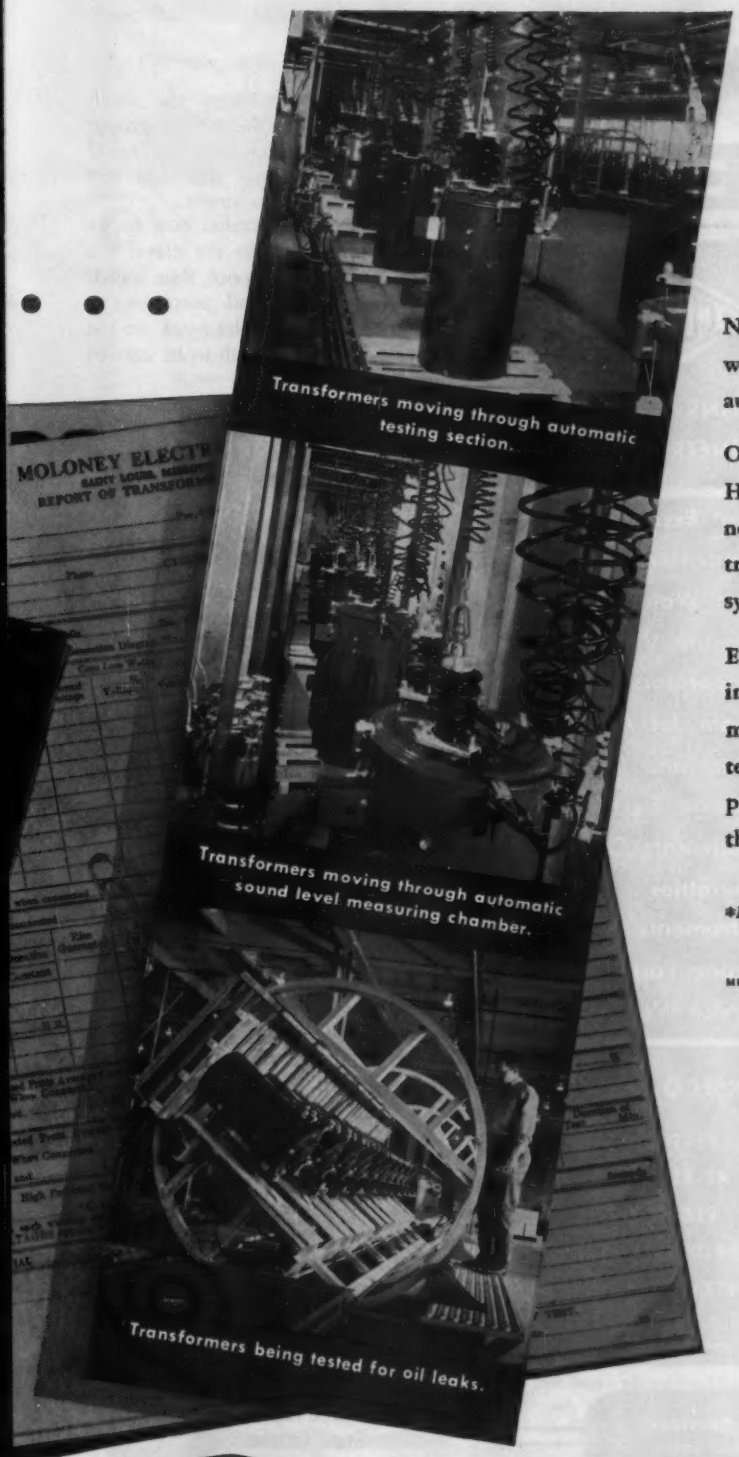


CERTIFICATE OF QUALITY . . .



Typical Surge Pattern.

MOLONEY ELECTRIC COMPANY


Transformers moving through automatic testing section.
Transformers moving through automatic sound level measuring chamber.
Transformers being tested for oil leaks.

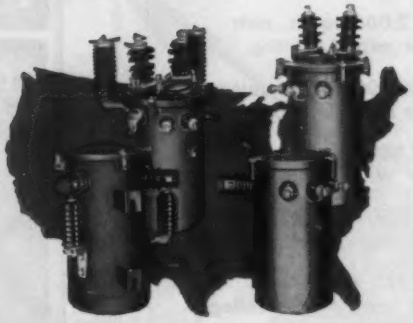
Now each Moloney HyperCore Transformer writes its own certificate of quality . . . automatically . . . before it leaves our hands.

Our new, enlarged production facilities for HyperCore Distribution Transformers are now in operation to produce more transformers individually test-proved for your system, in Moloney's Automatic Test Area*.

Experience since 1896, the latest techniques in engineering and design, modern manufacturing methods and *automatic* test facilities insure Moloney's continued production of quality transformers in the quantities and ratings you need.

***Patent Applied For**

ME97-8



HyperCore Transformers are available from stock in all standard ratings in both Conventional and CSP designs.

MOLONEY ELECTRIC

Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

LET'S LOOK AT THE CONSECO RECORD

• CONDENSER INSTALLATIONS

Three 70,000 sq. ft. units
for City of Los Angeles, Calif.

One 45,000 sq. ft. unit and two 20,000 sq. ft. units
for Puerto Rico Water Resources

One 28,000 sq. ft. unit
for City of Owensboro, Kentucky

One 33,000 sq. ft. unit
for Penn Power Co., Newcastle, Pa.

One 30,000 sq. ft. unit
for Northern State Power Corporation

One 35,000 sq. ft. unit and three 12,000 sq. ft. units
for Dairyland Power Cooperative

Plus hundred of units ranging down to 125 sq. ft.

• UNDER CONSTRUCTION AND ON ORDER

One 45,000 sq. ft. unit
for Transit Authority, N.Y.C.

One 27,500 sq. ft. unit
for City of Detroit, Michigan

One 12,000 sq. ft. unit
for export, Mining

One 12,000 sq. ft. unit
for Rushville, Indiana

Two 8,500 sq. ft. units
for Washington, Indiana

Three 7,500 sq. ft. units
for export, Fertilizer Plant

One 6,750 sq. ft. unit
for Texas A & M College

Conseco means Dependability

CONSECO

DESIGNS BUILDS
ENGINEERS ERECTS

- Heat Exchangers
- Condensers
- Feed Water Heaters
- Pressure Vessels
- Evaporators
- Steam Jet Air Ejectors
- Filters and Strainers
- Sewage Ejectors
- Condensate Coolers
- Specialties
- Instruments
- Engine Parts
- Service Water Coolers

CONSECO SERVICES

RE-TUBING
RE-BUILDING
REPAIRING
RE-DESIGNING
METAL SPRAYING

Bulletins on our Products and Services available upon request. Send for your copy.

CONDENSER SERVICE & ENGINEERING CO., INC. (CONSECO)

Designers and Builders of Equipment for Power, Refining, Chemical and Marine Industries

68 BLOOMFIELD ST.
HOBOKEN, N. J.

Oldfield 9-4425

N. Y. Telephone Barclay 7-0600

Block Helps

(Continued from page 90)

around the pole below the clevis when pulling conductors to proper tension for attachment to spool clevises. This sling was tied and untied at each attachment.

The device illustrated now hooks the pulling block to the clevis pin directly under the spool, thus speeding the process and permitting a more direct pull. The hook on the device is small enough to be carried on a lineman's belt.

The device may be readily attached below any spool where it fits snugly. It does not slip or fall, and all linemen in the Bluefield crew now use one.

SYSTEM ENGINEERING—Dispatching

Snap-on Buttons Show Board's Switch Positions

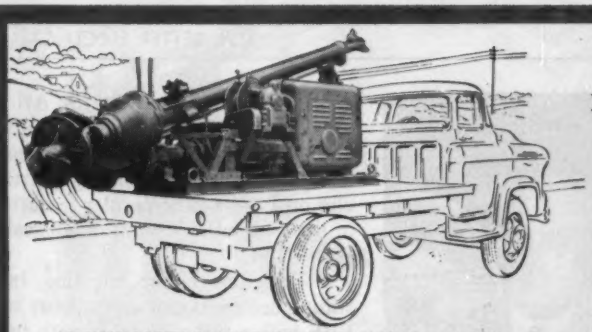
D. C. JETER, Chief System Operator, South Carolina Electric & Gas Co, Columbia, S. C.

Colored snap-on buttons indicate the positions of switches in a new dispatcher's board installed by South Carolina Electric & Gas Co. Besides simplifying the changing of symbols for switch positions, the buttons cost less than pins.

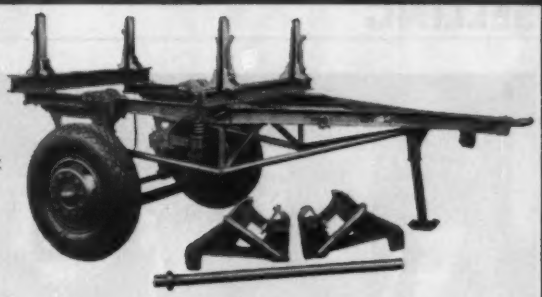
Buttons snap over the round heads of special nails pounded into holes drilled in the board. Space is sufficient between the button and board for a heavy paper tag indicating clearance or testing. Buttons and tags cannot be brushed off easily. Red colored buttons represent closed switches; white open switches.

The board consists of 4-ft squares of $\frac{3}{16}$-in. plexiglass mounted on plywood backing. Plexiglass for the facade is easy to clean and reflects light uniformly. Affixed to the board is colored tape representing different voltage lines. Other symbols and numbers are cut from colored paper and cemented to the board.

Uniform illumination of the board is provided by 13 recessed luminaires, containing incandescent lamps. General office illumination is from other similarly recessed fixtures.



"HCMS" EARTH-BORING MACHINE, Skid-Mounted. Digs the hole in any type of soil . . . 9 to 36 inches in diameter up to 10 feet deep . . . and sets the pole. Powered by a separate engine mounted integrally on steel skids. Entire machine may be quickly mounted or removed from truck platform.



"PCP" COMBINATION TRAILER. Combination pole and cable reel trailer. Bolsters with sliding cam-locking stanchions are quickly mounted or removed as required. Cable reel saddles can be attached quickly and securely. Adjustable to different width reels.

HIGHWAY

PROVEN PERFORMANCE IN UTILITY-CONSTRUCTION EQUIPMENT

Highway utility equipment is designed, engineered and built for safe, dependable performance . . . specifically for the job required . . . and for long, trouble-free service life at low operating cost. A strict program of quality control has earned Highway the reputation as the leader in every detail of utility equipment production. Whatever your needs or requirements in line construction and maintenance equipment, Highway's advanced design, practical engineering and extensive production facilities can solve your problems.

SWING-BASE EARTH-BORING MACHINE. Swing base allows rotation of the boring machine 180° — plus extension up to 22 inches. Provides a nearly infinite number of digging positions. Hydraulic operation. Truck-mounted. Extreme flexibility and exact positioning regardless of location or angle.

"B" HYDRAULIC EARTH-BORING MACHINE. New Highway digger is completely hydraulic in operation. Pressure-feed—digs through frost and hard-pan. Can be used either front or rear mounted . . . with any hydraulic derrick. Unit is self-storing. Lays across roof, takes no space on body.

HIGHWAY

A Division of Merritt-Chapman & Scott Corp.

UTILITY DIVISION

HIGHWAY TRAILER COMPANY

HEADQUARTERS: EDGERTON, WISCONSIN

Manufacturers of: Public Utility Bodies • Earth-Boring Machines • Pole and Cable Reel Trailers • Winches • Power Take-offs • Service Accessories • Commercial Trailers • Trailerized Tanks and Dry Bulk Haulers.

SALES AND SERVICE IN PRINCIPAL CITIES

LBE's Hoppin Addresses Boston Ad Club

Live Better . . . Electrically made a few more friends recently when the Project's program manager, Phil Hoppin (seated on the right) addressed the Boston Advertising Club at a luncheon meeting sponsored jointly by the Club and the Electric Institute, Inc, of Boston in observance of National Electric Week.

Hoppin gave a brief history of LBE, its activities to date, its plans for the future, and its potential to ad men as an account and profit builder.

Seated with Hoppin is Claude Lawrence, president of the Institute. Those standing are (1 to r) R. A. Berenson, president of the Ad Club, J. Waddell, executive secretary of the Institute, and Al O'Malley, New England Electric System's merchandising manager.

Associations Go to Bat for LBE

Utilities and other LBE supporters can look to strong programs from national industry-trade associations in the coming year. Here's what a few of them have lined up:

• Edison Electric Institute chose "Live Better . . . Electrically" as its residential sales slogan for 1957, and is spearheading a plan to develop additional manufacturer LBE support. EEI has gotten utility executives to go out in the field and make personal contact with top manufacturing people. This has been going on since December of last year, and is a continuing program. The Institute set up January's LBE Womens' Conference, in an effort to appeal to "American Woman" market.

• American Bank Association is passing out materials to its 15,000 members in which LBE figures prominently and constantly. Two goals behind this activity for ABA are: (1) stimulating rewiring loans, and (2) easing home improvement and electrification financing. Articles on LBE will be regular features of the association's monthly journal, BANKING.

• American Home Lighting Institute demonstrated its support of LBE with a full-page tie-in with the industry's supplement in Publisher's Auxiliary timed to break with National Electric Week.

• American Home Laundry Manufacturers Association has sent out the latest LBE material to its members, including the LBE Plans Book for 1957, and the LBE manufacturer tie-in booklet.

• National Association of Home Builders sent out to all chapter secretaries the regular NAHB promotion kit containing Live Better Electrically publicity materials, a special supplement, and the LBE quiz folder. The kit is designed to help builders promote home shows.

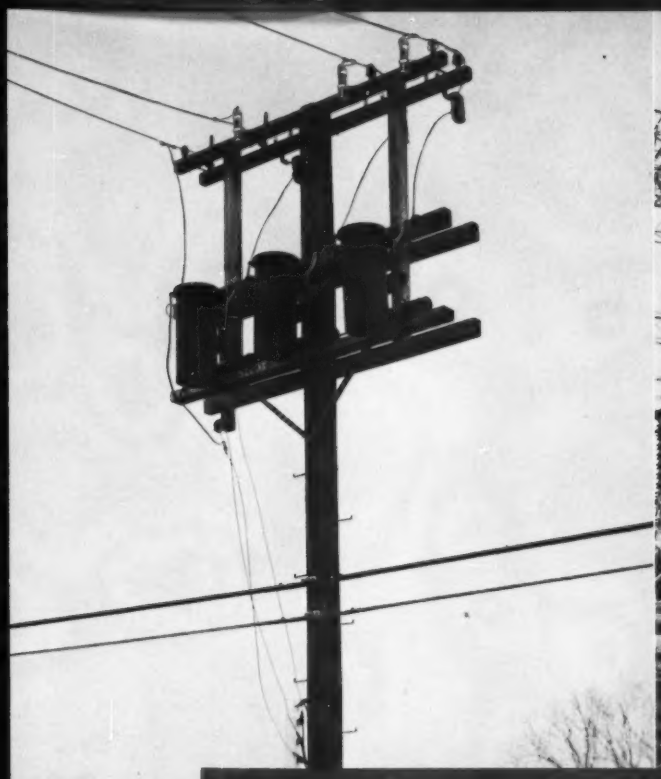
• National Rural Electrical Cooperative Association featured "Live Better . . . Farm Better . . . Electrically" at its annual meeting in Chicago early in March. An LBE women's program included talks, recipe sessions, an electronic range demonstration, and a film-strip on farm-kitchen planning. There was also a 4-member panel discussion on LBE. NRECA has also sent out LBE material to its members.

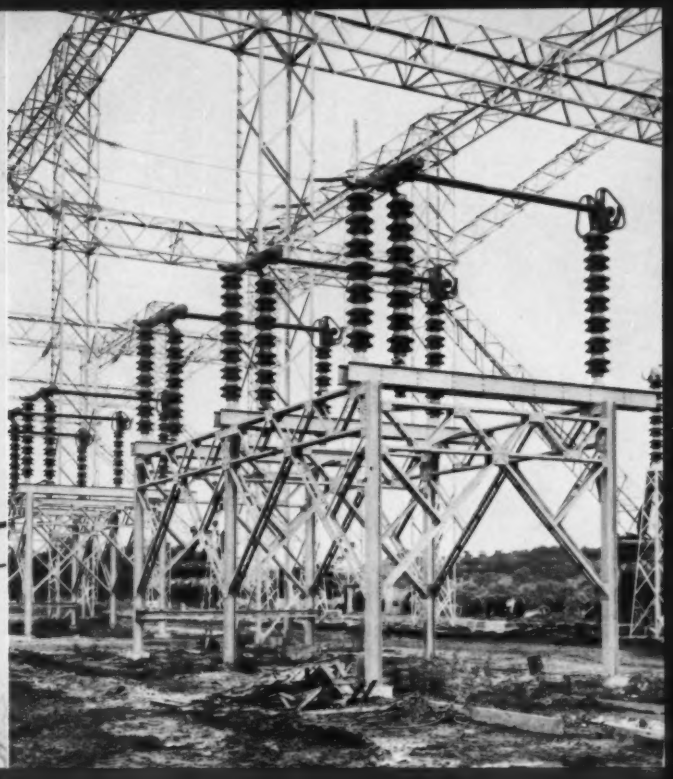
• National Association of Electrical Distributors has sent Live Better Electrically plans book to all its members. R. E. Ingmire, LBE's manager of inter-industry activities gave a talk on the NAED's electrical housewares committee meeting in January.

• National Adequate Wiring Bureau has cooperated extensively in LBE work. NAWB participated in the industry's Publisher's Auxiliary supplement, and integrated the LBE theme into many of its presentations at the recent NAWB conference.

• The Washington, D. C., meeting for the January 30 telecast was sponsored by a group of industry associations for the purpose of acquainting government and congressional leaders with LBE.

(More Selling on page 101)



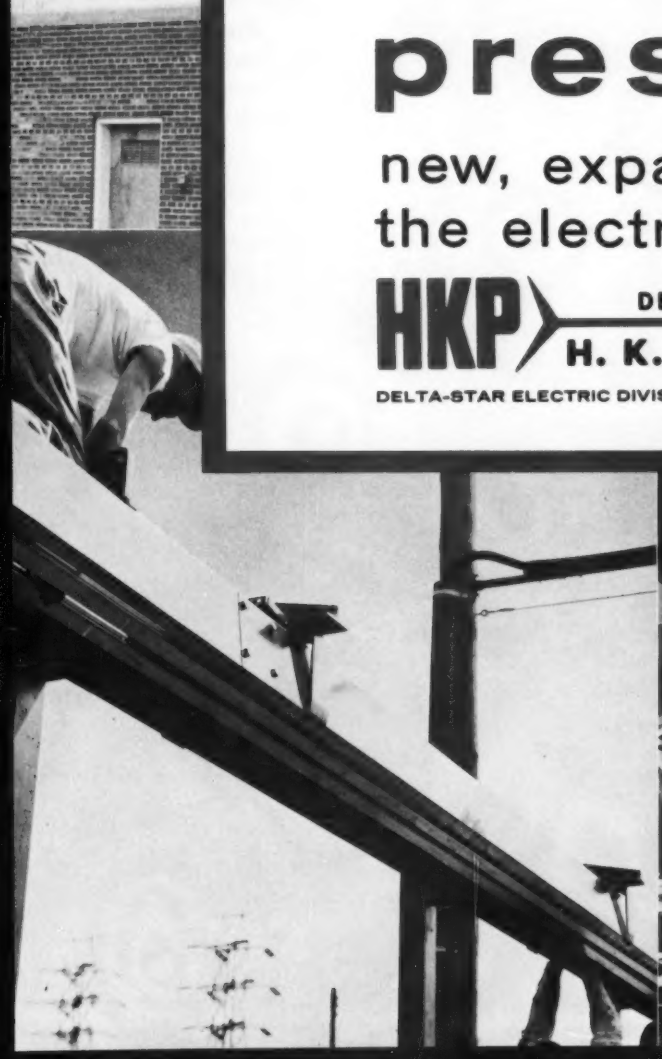


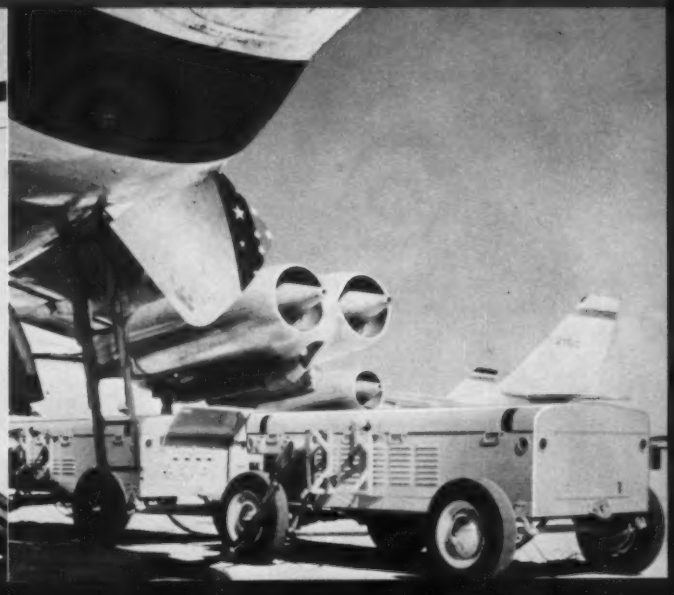
presenting

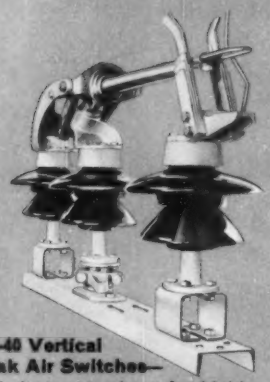
new, expanded service to the electrical industry by

HKP DELTA-STAR ELECTRIC DIVISION
H. K. PORTER COMPANY, INC.

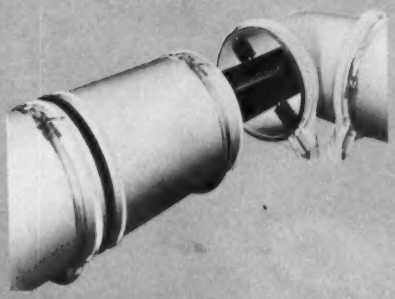
DELTA-STAR ELECTRIC DIVISION • ELECTRIC SERVICE WORKS • ESECO WORKS



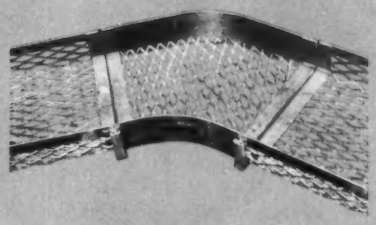




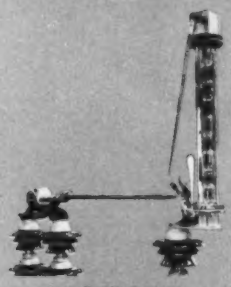
MK-40 Vertical Break Air Switches— the industry stand-out for highly efficient, dependable service at low ultimate cost.



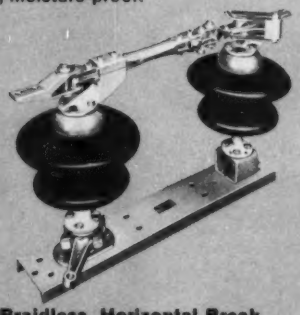
Delta-Star Telescoping Cover Bus— features time-saving installation, quick inspection, moisture-proof.



Uni-Tray Cableway with unique Wedgit fittings that make installation quick and easy.



Interrupter Switches— MKV-40 interrupter shown above has series of vacuum switches; Powerupter switch also available.



PMB Braidless, Horizontal Break Switches develop high pressure contacts with exceptional ease of operation.

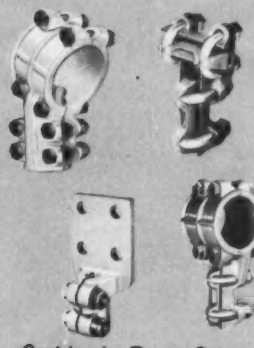
New Terminators— featuring simplified design and economy, plus customary Delta-Star high quality.

Crystal Valve Lightning Arresters provide split-second reaction against lightning, and feature extremely high efficiency.

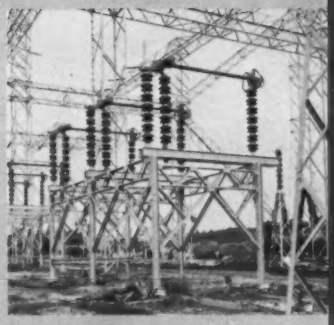
Cougnard Deioniser— designed to protect high voltage electric installations against high frequency atmospheric discharges.

Ladder Mounts engineered for fast-action, extra-safety, and one-man operation.

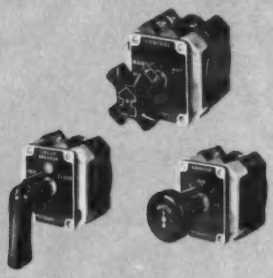
To meet your present and future needs, turn to Delta-Star's ever-expanding product line



Cast-to-size **Power Connectors** —highly efficient contacts, strong gripping action, durability.

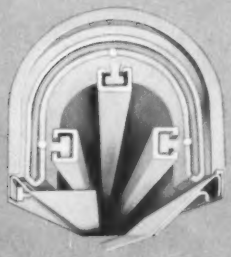


Substations—complete designing and fabricating service.

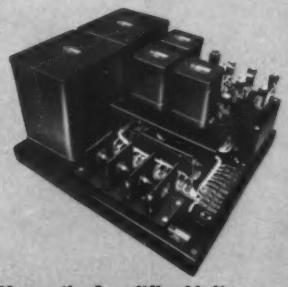


Control Switches featuring new compactness, simplicity, ruggedness and versatility.

Generator Control Switchboard —governor control, synchronizing equipment, voltage regulator, breaker and transfer switches.



Lec-Trol-Feed Conductor Systems feature fast installation, maximum safety (other systems also available).



Magnetic Amplifier Voltage Regulator for precise power control utilizing newest silicon circuit elements.

COMPLETE LIST OF PRODUCTS DELTA-STAR ELECTRIC DIVISION H. K. PORTER COMPANY, INC.

DELTA-STAR

Substations
Powerupter and Vacuum Tube Switches
Outdoor Disconnecting Switches
Indoor Disconnecting Switches
Arc Suppressors
Isolated Phase Telescoping-Cover Bus
Heavy Duty Industrial Buses
Bus Supports
Power Connectors
Spool Insulated Cable Supports
Cable Terminators (Potheads)
Uni-Tray Cableway
Crane Rail Supports
Control Switches

ELECTRIC SERVICE WORKS

Crystal Valve Lightning Arresters
Cougnard Deionisers
Ladder Mounts
Lec-Trol-Feed Conductor Systems
Integrated Conductor Systems
Crane Rail Supports

ESECO WORKS

Metal Enclosed Switchgear
Precise Power and Control Equipment
Magnetic Amplifier Voltage Regulators
Voltage and Frequency Sensing Devices
Generator Sets
Aircraft Ground Support Equipment

Two major development programs demonstrate the growth-to-serve-your-needs-better policy of Delta-Star Electric Division, H. K. Porter Company, Inc.

One program is represented by the combining of Electric Service Works (formerly Electric Service Mfg. Company), and Eseco Works (formerly Electric Service Engineering Co.) into the Delta-Star Electric Division. This divisional expansion produces improvements and economies of research, manufacture and distribution that will be passed along to you.

The second program is one of new product development. Within an 18-month period, Delta-Star alone introduced ten new or decidedly improved products—new telescoping-cover bus, new Powerupter switches, new vacuum tube switches, three new horizontal break switches, quick-whip arc suppressor, Uni-Tray cableway, new control switches and a new line of terminators.

Delta-Star's Electric Service Works recently introduced its new Lec-Trol-Feed conductor system, and the new Cougnard Deioniser.

Among products recently developed by Delta-Star's Eseco Works are a new magnetic amplifier voltage regulator, voltage and frequency sensing device, and precise control group-units.

The scope of Delta-Star's expansion, and the impact of these new products and improvements, are certain to reach you—in electrical utilities, industrial plants and in research activities.

You may obtain the resulting benefits soon by contacting the *Delta-Star Electric Division, H. K. Porter Company, Inc., Chicago 12, Illinois.*

Eseco Works plant
Lockport, Illinois

Delta-Star Electric Division plant
Chicago, Illinois

Electric Service Works plant
Philadelphia, Pennsylvania

Here's where you can obtain additional Delta-Star service

Mapped above are the contact points throughout the United States where Delta-Star representatives are ready to serve you. These men can tell you more about Delta-Star products—and, whenever needed, arrange for additional service from headquarters engineering departments.

Also look to Delta-Star Electric Division, H. K. Porter Company, Inc. for *increasing* service to the electrical industry. Continued forward movement is certain. Additional new products will be introduced, as you need them. You and the electrical industry will benefit from such expansion.

For any additional information you may want, check your local telephone directory for your local Delta-Star representative—or contact Delta-Star Electric Division headquarters.

DELTA-STAR ELECTRIC DIVISION
H. K. PORTER COMPANY, INC.
2437 W. Fulton Street • Chicago 12, Illinois

ELECTRIC SERVICE WORKS
17th and Cambria Sts. • Philadelphia 32, Pa.

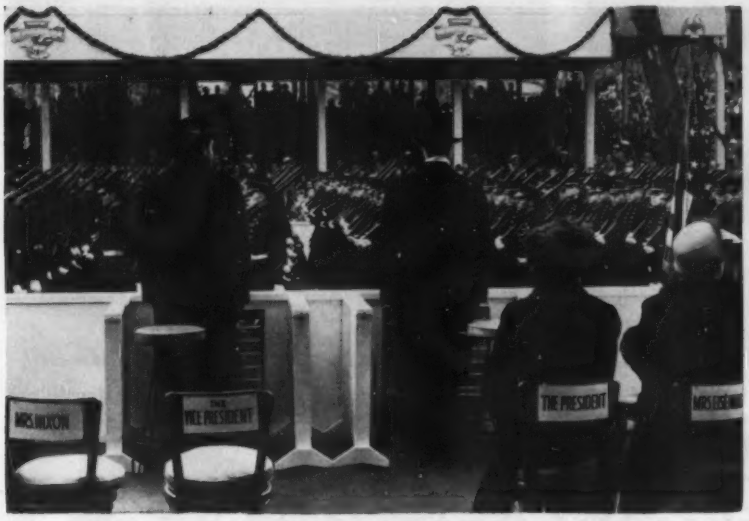
ESECO WORKS
11th and Commerce Sts. • Lockport, Illinois

HKP

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.

Divisions of H. K. Porter Company, Inc. are: Connors Steel, Delta-Star Electric, Henry Disston, Laclede-Christy, Leschen Wire Rope, McLain Fire Brick, Quaker Rubber, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings.



No Cold Feet at this Inauguration!

Two well known gentlemen unknowingly supplied us with still another use for electric space heating equipment. Here President Eisenhower and Vice President Nixon take a review at their second inauguration before two well placed radiant electric heaters. Note the units installed in the reviewing stand wall directly in front of them. The day, you may recall, was damp and bitter, and we're sure the heaters were well appreciated during the long parade.

H & C BRIEFS

Comm Ed Holds Heat Seminar

Following its plan to get more experience in electric space heating, Commonwealth Edison Co recently held a 4-day seminar on the subject for 20 power sales reps from throughout its systems. The course was planned to help the representatives give the customer technical assistance and information on residential, commercial and industrial electric space heating.

Electric Heat "Ready" Now

Detroit Ed's house organ, The Synchroscope, answered a recent query in the Detroit News about whether electric heat will be ready in 15 years by saying that it is "ready" now. Query had reference to a predicted fuel shortage. DE says customers choose electric heat by comparing over-all cost advantages, not just fuel prices.

WWP to Promote Electric Heat

Washington Water Power Co announced recently that it will actively promote electric heat for homes in eastern Washington and northern Idaho. Based on a 2-year study of 51 homes, electric heat averaged $169 per home annually. This is less than WWP estimated.

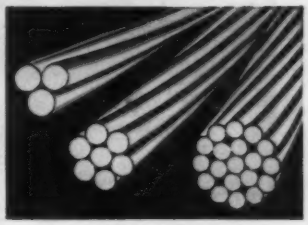
Wiegand Co Training Utility Men

Edwin L. Wiegand Co, manufacturer of Chromalox electric heating equipment, is continuing its triweekly Electric Heating Workshops for utility people. So far, utilities from as far west as Nebraska, as far south as Georgia, and as far north as Maine, have had men attend. For information, write the company at 7500 Thomas Blvd, Pittsburgh 8, Pa.

(More Selling on page 102)

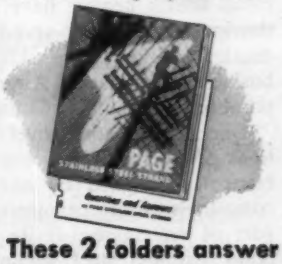
PAGE

Stainless Steel Strand



Its low cost per year means true economy

• Whether you are installing new lines or replacing old ones, bear in mind that the cost of even the finest material is only a small fraction of the total cost. You will find real economy in using PAGE Stainless Steel Strand—the finest made. It is higher in strength-to-weight ratio, tensile strength, elastic limit, and resistance to corrosion and abrasion. It lasts longer, needs replacing less often—this means less cost per year of use.



These 2 folders answer many questions about Stainless Steel Strand

• How does PAGE Stainless compare in conductivity with copper; with steel? How about comparative corrosion resistance; fatigue resistance? How about adaptability to diverse uses? These and many other questions are answered in two informative folders. Ask for **Folders DH521** and **DH288.** Write us at Monessen, Pa.

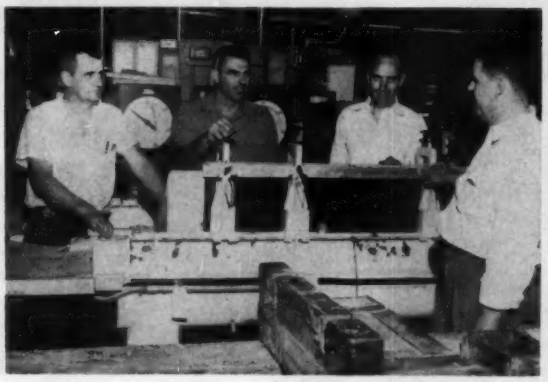
Another fine PAGE product

• PAGE Stainless Steel Lashing Wire is ideal for lashing conductor cables to a strand messenger by machine. Available in 3 grades—each in 2 sizes.

ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE



ELECTRIC BLANKET of impregnated rubber forms part of 18-ft jig that bonds stainless steel leading edge to 'copter blade

INFRARED LAMPS on adjustable racks cut curing time in rib-gluing fixture to 30 minutes. Each blade spar has 128 ribs

Electric Heat Makes Helicopter Output Soar

F. W. RIGGS, Industrial Sales Engineer, The Connecticut Light & Power Co, Thompsonville, Conn.

They're really putting the heat on at one of the country's leading helicopter manufacturing plants. Electric blankets, infrared lamps, and metal sheath heaters have all been thrown into service to speed up production and keep pace with the new business at the Kaman Aircraft Corporation, Bloomfield, Conn.

One of the most novel applications of electric heat is the electric blanket. Designed by one of the company's tool engineers, it is part of an eighteen-ft jig used to bond stainless steel leading edges to the helicopter blades. Made of carbon impregnated rubber and surrounded by a collapsed air hose, the blanket forms the bottom part of the jig. Its rated output is 15 w per square inch.

When compressed air is released into the air line, the collapsed hose inflates and exerts a pressure on the blanket. This increased pressure on the blanket forces the creased stainless steel plate firmly against the freshly glued leading edge of the rotor blade. In four hours, including cooling-off time, the concentrated heat from the electric blanket has solidly bonded the plate to the massive blade.

Glue drying once consumed valuable production time at Kaman. Now, in just thirty minutes, a bank of twelve, 3,000-w infrared heaters, mounted on adjustable racks, can do a drying job that once took several hours. Operating at a temperature of 175 F, the lamps are set up near the rib-gluing fixture where 128 wooden ribs are secured to each blade spar. And on a multitude of other glue-drying jobs throughout the production phase, Kaman's plant and process engineers have put the regular, even heat of the infrared lamp to work to shorten the curing time required. Metal sheath heaters are in action throughout the plant. Plastic dip tanks, acid tanks, and radiant heating slabs all use metal sheath heaters in one form or another. In an aluminum heat treating tank, sixteen 4,200-w stainless steel, tubular heaters provide steady, even heat, unaffected by the corrosive action of the salt bath. In another application, twenty tubular heaters, each 65¾-inches long and rated 22 w per square inch are being installed to provide the heat supplement for the platen of a large press which compresses aluminum and magnesium sheets 0.015 to 0.1 inches thick.

Electricity Cure For Dust Bowl, Floods?

(This load builder first appeared in the "letters" column of a Texas daily)

To prevent dust storms we should start by terracing our land right up to the mountain tops. This would walk the water down the hills one step at a time so it would not wash away the land. Then we should [go up] to our Great Lakes and [start] a canal across country and on each river build a dam and have the canal leading from river to river until it reaches the Dust Bowl. We could bring ships into the cattle country and have water transportation right back to Chicago.

Then we could pipe water from the Pacific with electric pumps through stills to remove the salt. We could tap this water with small pipes to spread it over the country and use our electricity to make it rain. To help further, we could put electric warmers up above the mountains and along our river banks to keep this water moving all winter. When spring came we wouldn't have excessive amounts of water flooding the land all at once.

No doubt you are wondering where the power for moving this water is coming from. Our dams, of course. What a sight to visualize —the Dust Bowl in bloom and covered with green vegetation.

YOU GET

LONG-LASTING PROTECTION FOR YOUR OVERHEAD SYSTEM

with

BLACKBURN *Grounding* DEVICES

Type GTC 1
One plate tower ground clamp

Type GTC 2
Two plate tower ground clamp

Copper Bonded Pigtail

Type GUV
U-bolt ground clamp parallel or 90°

Steel Driving Stud for Sectional Ground Rods

Type GG
Ground Rod Clamp
Socket set screw

Copper Alloy Coupling for Sectional Ground Rods

Copper Bonded Sectional Ground Rods

Copper Bonded Regular Ground Rods

Type GGH
Ground Rod Clamp
Square head bolt

Type B
Budget Line Ground Rod Clamp
Square head bolt

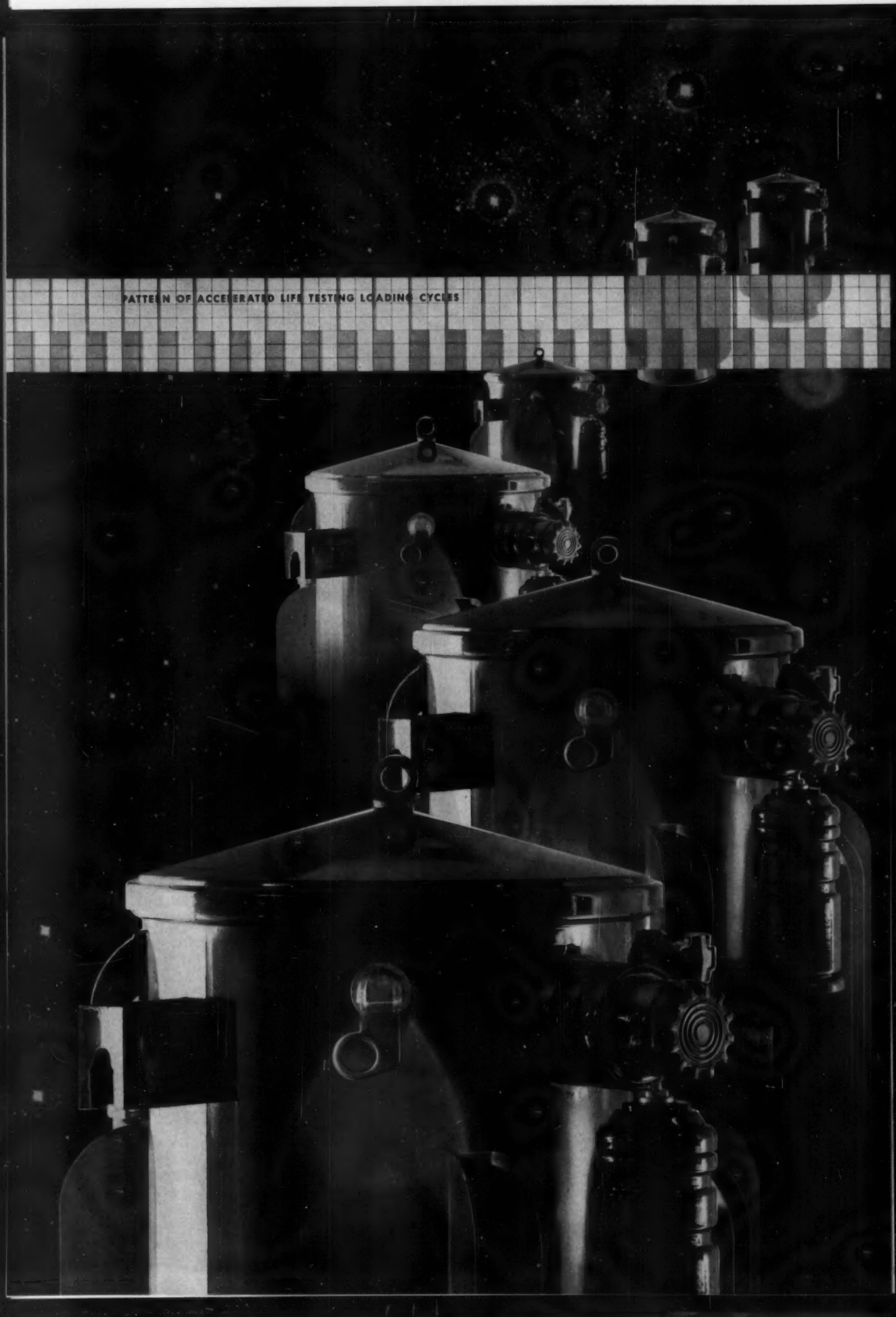
Type GP 100
Electrolytic Copper Pole Bottom Plates
7½", 10", 14" dia.

Blackburn grounding devices will save you thousands of dollars annually in preventing burnouts of expensive overhead equipment. This complete line simplifies your stocking problem—one source for all your needs. Like all BLACKBURN products they are constructed of high-strength corrosion resistant materials—designed for easy installation and engineered for long-lasting, trouble-free grounding. Always specify BLACKBURN.

Available Through Electrical Wholesalers Everywhere

DISTRIBUTED ON THE WEST COAST BY
KORTICK MFG. CO.

JASPER BLACKBURN CORPORATION
ST. LOUIS 6, MO.
35 Madison Street — Phone MAin 1-2821


PATTERN OF ACCELERATED LIFE TESTING LOADING CYCLES

Helping the industry meet its growing loads

Transformer life-testing today . . . a new "known" to help you plan 1987 equipment investment

Increasing loads, changing load patterns dominate the industry's equipment planning today. These same factors are forcing transformer investment programing further into the future, further into the unknown of ultimate transformer performance.

Throwing new light onto such problems as load capability, equipment aging, transformer retirement is a unique new Westinghouse concept—accelerated life-testing of distribution transformers. Life-testing means transformers are subjected to a series of tests representative of actual service conditions—30 years of normal equipment life are packed into three. Range of tests and duty cycles used provide a complete thermal, electrical and mechanical life-performance check on completely assembled, standard transformers.

Now, and for the first time, the effect of design changes on the life expectancy of a transformer is predictable. Already, accelerated life-testing offers utilities a complete prove-out on the recently announced 20% increase in overload capability of all Westinghouse distribution transformers.

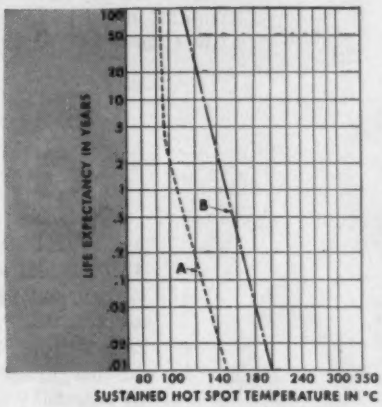
The evidence being gained from functional life-testing permits more accurate forecasts of the service life expectancy of transformers under a wide range of conditions. It will help you load transformers closer to optimum. Permit planned change-out schedules. Enable you to utilize equipment more fully. In short, here is a new and singular management tool to help utilities mate products to modern load demands. J-97190

YOU CAN BE SURE...IF IT'S

Westinghouse

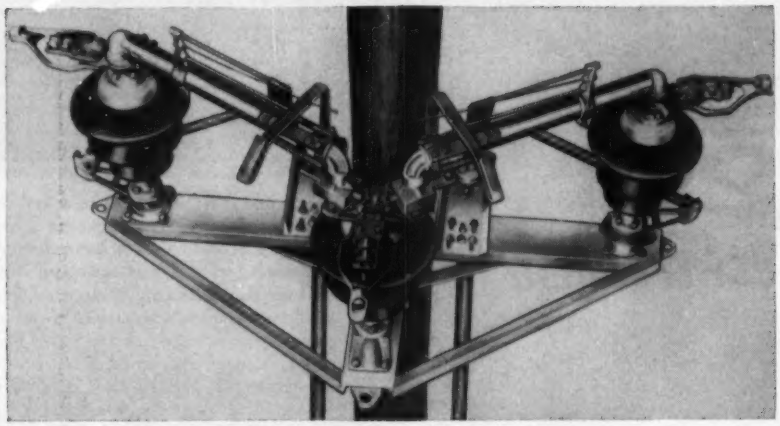
Pretesting Transformer Life . . .

Functional life-testing is a new and realistic technique for establishing life-expectancy standards for transformers. Pioneered by Westinghouse and developed by A. M. Lockie, design engineer, this accelerated life-testing is programed in two ways—testing to the point where transformers are no longer fit for service, and testing to destruction. Procedures are based on experience obtained from putting transformers through 2,200 overloads, 30 short circuits at 15 times rated current, a series of impulse, dielectric and induced potential tests, and daily load cycles up to 450% of rating. For full description, see Lockie's AIEE papers, "Functional Life-Expectancy Tests for Liquid-Filled Transformers" (55-520 and 53-243).



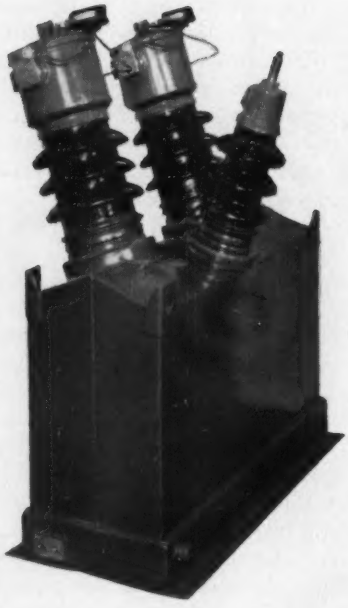
Data obtained from functional life-tests now shed new light on transformer life expectancy, and show the practicality of heavier loading. Curve "A" is the life-expectancy curve derived from the ASA guide for loading transformers—the generally accepted guide before the development of functional testing. Curve "B" was published by Westinghouse in 1953 as the result of early functional tests which helped to determine circuit breaker settings used then. Tests conducted since 1953 show that, for Westinghouse distribution transformers, even curve "B" is conservative, and have led to the pioneering of higher breaker settings. Here is a new "known" to help you plan 1987 equipment investment.

Call your Westinghouse representative for more information.



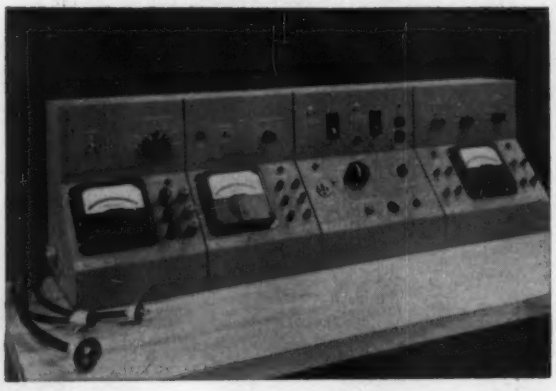
Group-Operated Switches

Type "GS" group-operated air break switches, designed for vertical phase-above-phase mounting on single poles, are available in 2-way (shown) and 3-way models. Ratings include 7.5 through 69 kv at 400, 600, and 1,200 amp. Contacts are silver-to-silver. Snap-out arcing horns develop high tip speed for interrupting magnetizing and charging currents.
A. B. Chance Co, Centralia, Mo.



Metering Units

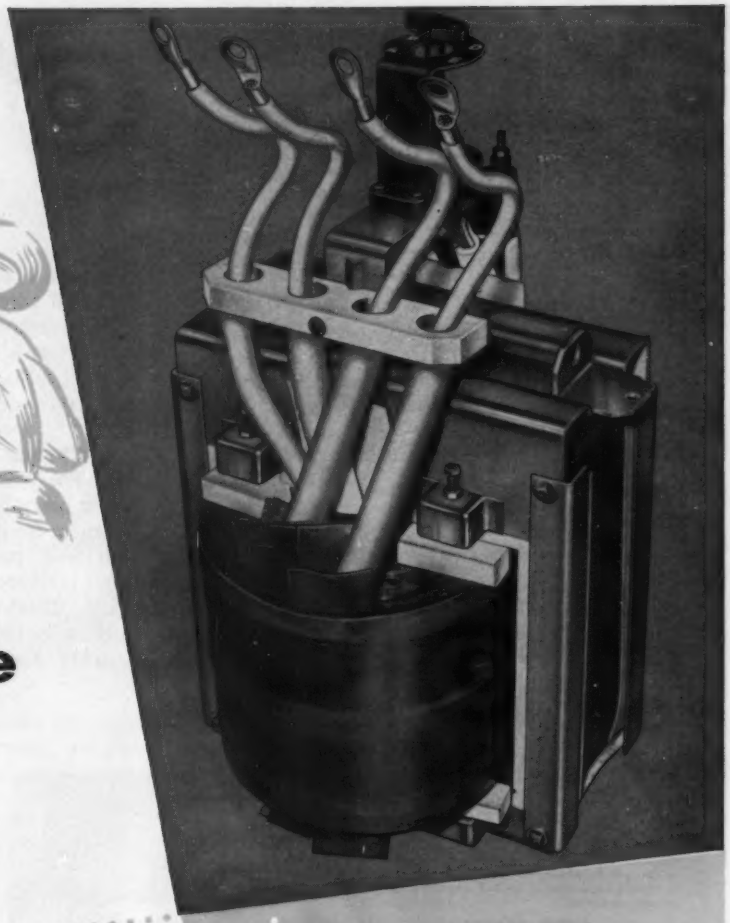
For indoor or outdoor metering, relaying or control use, type FMU formfit metering units are reportedly 42% smaller and 62% lighter than earlier units. With current and potential units in one oil-filled case, units are available for 25 through 69 kv service with primary ratings from 10/20 through 400/800 amp. Series-parallel primaries provide double current ratio, selected by externally operated, oil-immersed switch.
Westinghouse Electric Corp, Box 2278, Pittsburgh, Pa.



Instrument Test Sets

These bench test sets are intended for calibrating a-c and d-c field instruments in utility laboratories. Reported to meet exacting laboratory standards, they can be used to test voltmeters, ammeters, or milliammeters. A basic set is composed of four separately housed sections, including an adjustable power source, and is said to require a minimum of connections and handling.
Multi-Amp Corp, 465 Lehigh Ave., Union, N. J.

(More New Equipment on page 108)



Rugged Performance

built into core and coil assembly of Central Distribution Transformers

Only the best raw materials, design, workmanship and inspection go into core and coil assemblies of Central Distribution Transformers.

Grain oriented, cold rolled steel is used in the wound core design. Maple blocks are attached to the sturdy frame on all core and coil assemblies, 15 KVA and above, to prevent shifting of the coil under overload or short circuit conditions.

The tap changer has a glazed porcelain body and high conductivity copper alloy contacts. The molded bakelite handle extends above the hot oil level to assure easy and positive operation of the high pressure spring loaded contactor. A fiber board provides clear indication above oil of the position of the tap changer.

This rugged construction of the core and coil assembly is an important reason why Central Distribution Transformers have gained wide acceptance in the Electrical Industry.

A type for every need—from the smallest to the largest.

NEMA

Designers and Manufacturers of Transformers only

CTC

CENTRAL

TRANSFORMER CORP.

PINE BLUFF, ARKANSAS

Sales Offices in principal cities

COMPLETE SELECTION OF

TEST TABLES

offered by . . . THE STATES COMPANY

Leaders in Electrical Testing Equipment

States Test Tables require no special rotating standards and may be equipped to test 2 and 3 element meters, socket and bottom terminals, as well as single phase.

FORM "FRS"—Single position table with photo-electric control. Will test single phase and 2 and 3 element polyphase meters.

FORM "HAPBL"

Dimensions: 20" x 20" x 15". Other styles of this table may be furnished equipped with photo-electric control.

"FRD"—Two position photo-electric only or photo-electric and "push button" automatic sequence.

THE STATES COMPANY

19 New Park Avenue, Hartford, Conn.

Send me your new catalog on TEST TABLES.

Name .....Title.....

Firm Name.....

City .....Zone....State.....

Wire Bracket

An offset neutral wire bracket is designed to hold neutral wire away from the pole, in a different vertical plane from the phase wire. It is available in two models: No. 4473 for 6-in. to 8½-in. diam poles; No. 4474 for 8½-in. to 12½-in. poles.

Standard wet or dry type spool insulators are used. The bracket is supported by a U-style brace, welded to the horizontal member for greater rigidity and permanent position. Shoulder, square nut, and lock nut hold bracket to pole. Total extension from pole surface is 16½ in. **Hubbard & Co, 6301 Butler St, Pittsburgh 1, Pa.**

Utility Pockets

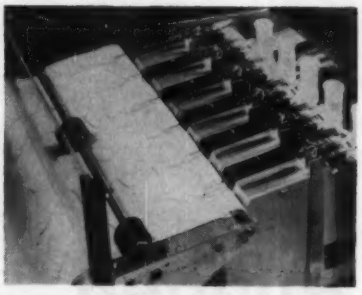
Model 5126 lineman's and electrician's pocket has two pockets for pliers and a 6.5 by 8.5-in. utility pouch. Model 5127 has three pockets for pliers and a 7 by 10-in. utility pouch. Both have two screwdriver pockets, a knife snap and a slotted back for attaching to belt. **Mathias Klein & Sons, 7200 McCormick Rd., Chicago, Ill.**

Relay Test Units

Portable relay test units are available in two models: Type RA1-1 for complete testing of switchgear components; Type RD1-1 for simple testing in a-c circuits of meters, protective relays, tripping coils, overload heaters, etc.

Said to reduce downtime. Manufacturer claims one man can move either unit. Further information in Bulletin 774.

Nelson Electric Manufacturing Co, P. O. Box 5385, Tulsa, Oklahoma



Oscillograph

This 8-channel, high speed, direct writing oscillograph, the Dynagraph, can use 1) ink or 2) electric sensitive paper for curvilinear recording or 3) heat sensitive paper for rectilinear recording. To simplify the shift from one medium to another, the styli can be lifted from their cradles without the use of tools.

A chopper amplifier, used for all applications, is reported to be stable and have a sensitivity of 15 μv/mm deflection. The same amplifier can be used with thermocouples for temperature recording, for all types of a-c and d-c recording, and with reluctance gages. Types MR and MCR are rack-mounted, type M a console, type MC a computer model, and type P a two-channel portable model.

Offner Electronics, 5320 N. Kedzie Ave, Chicago 25, Ill.

Aerial Ladder

The Series 2300 hydraulic ladder can be rotated or raised and lowered by remote platform controls. Available in 27, 31 or 35-ft maximum ground-to-platform heights, it can be rotated through 360 deg and elevated to a 75-deg angle by individual platform controls. Extension and retraction are controlled only from the base, by the main control levers. Other platform con-

(Continued on page 110)

new

Hubbard Aluminum Alloy Guy Protector

...lighter, stronger!

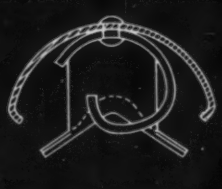
...lasts years longer!

This new Hubbard Guy Protector has all the features you ordinarily look for:

- quick and easy mounting—multiple attachment holes designed for universal application, at any height, to guy wires, rods and clamps.
- available in either 7 (Al-27) or 8 (Al-28) foot lengths, shipped in pairs.
- balance—equal rigidity and strength throughout.

Now . . . new, aluminum alloy construction brings you these *added* advantages:

- maximum corrosion resistance—even in heavy industrial areas or coastal salt air regions.
- lighter weight—easier stock handling and installation. 50-75% savings in shipping charges.
- better protection—turned lengthwise edges and new heat-treated aluminum alloy give maximum strength, durability.



Cross section view of top clip

Cross section view of bottom attachment

Head of bottom attachment bolt locks in place, will not turn as nut is tightened. Attaches over rod or strand. Attaches to clamp by substituting protector bolt for clamp bolt.

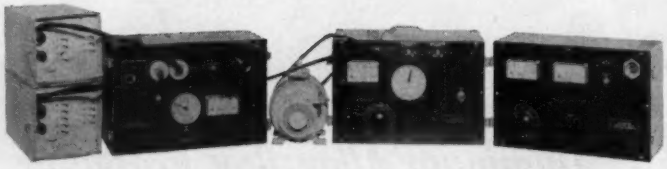
HUBBARD AND COMPANY

Sold exclusively through Electrical Distributors

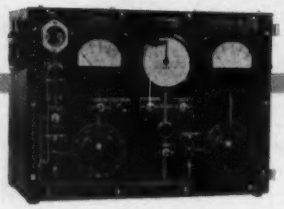
Pittsburgh 1, Pa.
Chicago, Ill.
Oakland, Calif.
Plano (Dallas), Texas

A NELSON FIRST

Portable Relay Test Units for proper testing and maintenance of switchgear components



Type RA1-1 Nelson portable test units which may be used in combination for complete testing of switchgear components.



Type RD1-1 Nelson portable test unit for simple testing of meters, protective relays, overload heaters, tripping coils, etc. For use with AC circuits only.

Use Nelson Relay Test Units to

Improve Operating Performance

Eliminate Excessive "Down-Time" when testing switchgear.

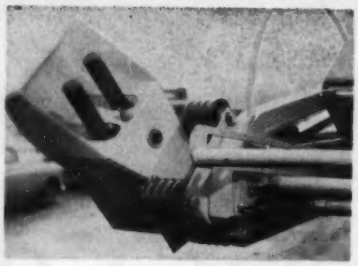
Up to now a complete rewiring job was necessary to test each different device in a piece of switchgear. Nelson's field service department, working with Nelson's engineering and research departments, has produced a portable relay test unit that will test relays, meters, coils, circuit breakers, etc.

Base your maintenance and inspection procedures around Nelson test units and be assured of economy in operation, less time spent in testing and generally improved performance of your equipment, resulting in less "down-time" and elimination of much lost production.

Write for Bulletin 774

A major source of Electrical Control Equipment for Industry

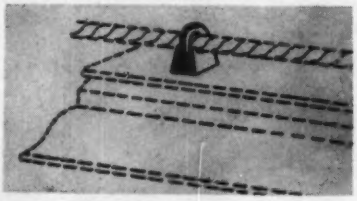
NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA



trols include an emergency-stop pushbutton and an on-off toggle switch.

Platform movement can be speeded up or slowed down by operating platform controls. Hydraulic power is generated by a power take-off or a separate engine-driven pump.

J. H. Holan Corp, 4100 W 150th St, Cleveland 11, Ohio.



Wire Rope Clips

Wire rope clips are available in a wide variety of sizes for suspending fluorescent lighting fixtures from cable run in continuous rows. Clips attach either to clamp hangers on fixture channel or directly to channel itself. Fixtures can run lengthwise or crosswise. Fitting is said to assure rigid support with fewer ceiling supports.

Malleable Iron Fittings Co, Branford, Conn.

Industrial Battery

Type TG Exide-Ironclad industrial storage batteries are designed for industrial electric truck installations where heavy demands are common. With a reported capacity of 72 amp-hr per positive plate (at the 6-hr discharge rate), they are said to provide a 20% increase in output with only 6% increase in weight.

A plexi-glas and polyethlyene tubing, fitted around each pencil, is

(Continued on page 114)

"It's Everybody's Family Tree!"

The familiar utility pole might well be considered "part of the family". Through the years it has supported the wires that bring light, warmth, communication and labor-saving energy into every home.

In countless locations, these wires are being supplanted by SIMPLEX SELF-SUPPORTING AERIAL CABLES, which have built an unmatched reputation for efficiency and dependability. For sixty-seven years, Simplex has pioneered in the design, development and manufacture of all types of aerial cables used for both communication and power distribution. The benefits of this specialized experience are yours for the asking. Write for Catalog 1006, which gives detailed information.

SIMPLEX WIRE & CABLE CO.,
79 Sidney Street, Cambridge 39, Mass.

LIVE BETTER ELECTRICALLY

Simplex

Wire sculpture by Henry Szafarz

Anhydrex Insulated, Neoprene Jacketed, Self-Supporting Aerial Cable

Longer engine life

One of 9 reasons why you'll find International Trucks cost least to own!

INTERNATIONAL engines are *all-truck built*. They are *not* adapted from passenger car designs—they contain *no* passenger car parts.

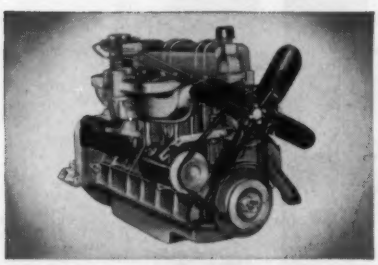
Every component of every INTERNATIONAL engine is built to do a truck-sized job—built to give *you* longer engine life.

The pictures below show you some of the other reasons why INTERNATIONAL Trucks will save you money over the years. Actual records kept by fleet operators prove* that INTERNATIONALS cost *least* to own! By spending more to *build* a truck—by putting more quality into it—INTERNATIONAL gives you a truck that costs least to operate.

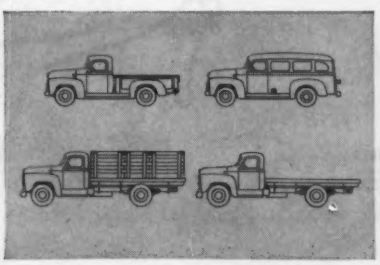
If you want to save real money in operating your trucks, the man to see is your INTERNATIONAL Dealer. Give him a ring today!

**Signed statements in our files, from fleet operators throughout the U.S., back up this statement.*

INTERNATIONAL HARVESTER COMPANY, CHICAGO
Motor Trucks • Crawler Tractors
Construction Equipment • McCormick® Farm Equipment and Farmall® Tractors



1 Lasting, usable all-truck power with six-cylinder, high torque engines. Timing gears are precision machined for longer, quieter operation. Sturdy, heat-treated crankshafts have big bearing areas for trouble-free operation.

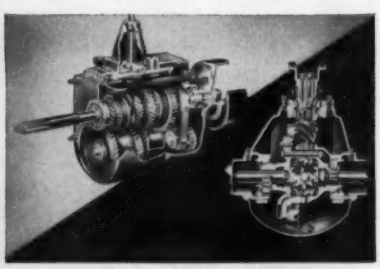


2 Seventeen factory-built bodies—3 pickups, 4 utilities, 1 panel, 1 Travelall,® 4 stakes and 4 platforms—104 combinations of bodies and models. Small or large loads, light or heavy, INTERNATIONAL meets all your requirements *exactly*.

3 Exclusive Comfo-Vision cabs feature colorful good looks, roomy comfort and life-saving safety. Soft, 3-men-wide seats, plenty of head and leg room make driving easier, less tiring. Wide, undistorted vision and low sloping hood.

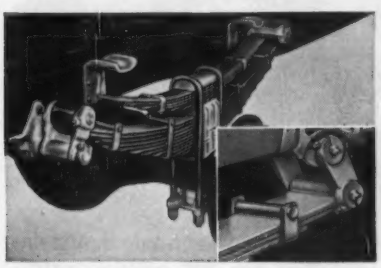
4 True geometric steering for safer, easier handling and short turning circles. Steering gears are mounted *ahead* of the front axle. Steering wheel is located in a natural, comfortable position. Power steering available on all models.

5 Safe, straight-line stops with less pedal pressure. Longer lining life with self-centering, self-energizing brakes that evenly distribute stopping effort over entire lining area. Powered brakes standard or available on all models.



6 Transmissions and rear axles in this range of models are offered in a wide variety of combinations to meet every requirement. You get the right capacity and proper final drive ratios for both speed and power . . . most economical operation.

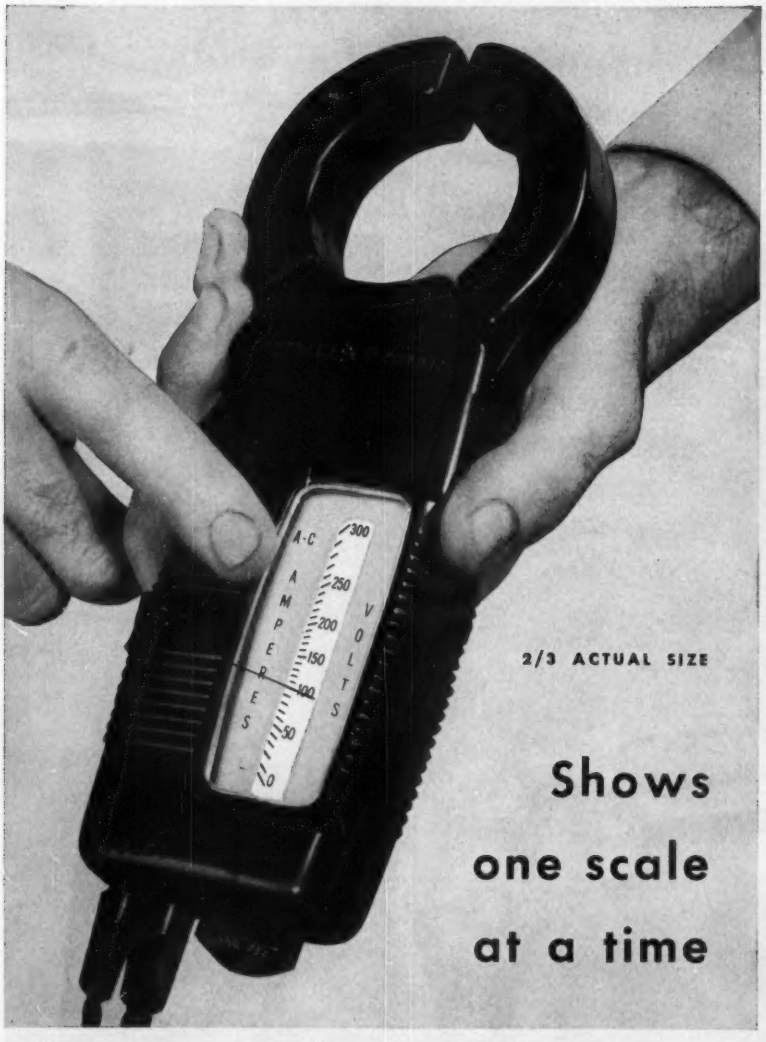
There are 27 basic conventional INTERNATIONALS in this 4,200 through 22,000 lbs. GVW class . . . 104 different combinations of bodies and models. Powered by 14 different engines, gasoline and LPG, with up to 212 hp. Every component of every model is built to save operating and upkeep costs... built to last and make more profits for you. Other INTERNATIONAL public utility trucks include all-wheel-drive models with 7,000 to 33,000 lb. GVW ratings.



7 Long, strong front and rear springs cushion the load and driver against road shocks and vibrations. Designed for better load support, smoother riding and longer life. Rear-shackled front springs increase stability and life.

8 All-wheel-drive Internationals have the extra traction and pull needed for all off-highway operations. Completely factory-built with 7,000 to 33,000 lbs. GVW. Low height with ample ground clearance. Complete selection of equipment.

9 World's most complete line. There is an INTERNATIONAL "tailor-made" for every truck job, ½ tonners to 90,000 pounders. Choice of 4-wheel, 6-wheel and all-wheel-drive models, conventional and COE design. Every one built to cost *least* to own.



G-E Hook-on Volt-ammeter Helps Avoid Reading Errors

RANGE AND SCALE of this G-E instrument show simultaneously by simply turning the fingertip control knob. Seeing only one range and scale avoids reading errors.

SCREW-IN VOLTAGE LEADS and recessed terminals provide maximum protection for the operator. Voltage leads cannot be pulled out accidentally.

WIDE RANGES ARE AVAILABLE in both models of the G-E hook-on volt-ammeter. Ranges of the AK-4 model are 0-10/30/100/300/800 amperes and 0-150/300/750 volts. The AK-5 ranges are 0-5/20/80/350 amperes and 0-150/300/750 volts. The wider range AK-4 model has a pointer-stop for accurate checking of surge readings.

FOR FURTHER INFORMATION, write Section 582-11, General Electric Co., Schenectady 5, New York and ask for bulletin GEA-6292, or contact your nearest G-E Apparatus Sales Office or Distributor.

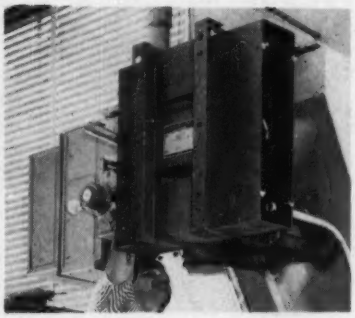
GENERAL ELECTRIC

Industrial Battery

(Continued from page 110)

claimed to prevent shedding of plate material which normally accumulates at bottom of case and shorts the plates.

Exide Industrial Div, The Electric Storage Battery Co, Philadelphia, Pa.



Transformer

Type M dry-type transformers with ratings through 50 kva single-phase and 150-kva 3-phase are available for commercial and institutional uses where noise level is important. Reportedly designed for a noise level of 45 db or less, these transformers are said to be dust-proof, drip-proof, and of fire resistant construction. Exposed core and absence of metal enclosure are claimed to permit no resonance.

General Electric Co, Schenectady 5, N. Y.

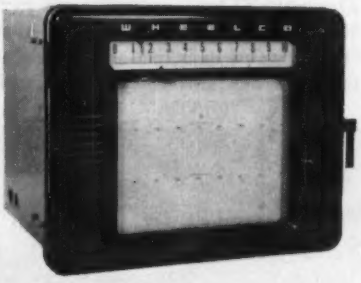


Chart Recorder

Series 8000 electronic multipoint recorders are null-balance instruments which can provide permanent recording of up to 16 points on one chart. Measurements may be

(Continued on page 116)

No bending problem here, because...

ROEBLING PAPER POWER CABLE WITH TELLURIUM LEAD ALLOY SHEATH HAS 4½ TIMES GREATER BENDING LIFE!

Roebling electrical wires and cables are available with either copper or aluminum conductors.

Yes, Roebling Paper Power Cable with tellurium lead alloy sheath takes that much more bending punishment than cables with copper-bearing lead sheath! And that's been proved time and again, not only in Roebling's laboratory bending fatigue test machine, in which lengths of cable are literally bent to death, but in field use over extended periods.

The uniform character of every inch of sheath and its high resistance to age-hardening, plus its unique stability under heat, assure long life under unusually severe conditions.

But there's an "inside" story to this cable, too. For the superior properties of this sheath are combined with a carefully constructed and tested inner cable made to meet the most stringent use demands. That's why, more and more, this cable is specified by name wherever cable has to last a long, long time.

Write for the full, interesting story today!

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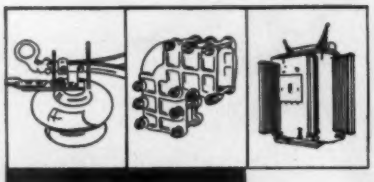
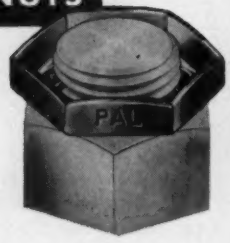
JOHN A. ROEBLING'S SONS CORPORATION
Trenton 2, N. J. • Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

Keep Nuts Tight
on all bolted assemblies



Apply
PALNUT
LOCK NUTS



PALNUT Lock Nuts apply so fast, lock so dependably . . . you can specify them for every nut-and-bolt assembly, at negligible cost. Maintenance is reduced on mechanical assemblies — full conductivity assured on electrical connections.

PALNUT Lock Nuts may be used on new or existing equipment. Easily removed and re-used when servicing. Require only 3 bolt threads. Available in Parkerized and hot dip galvanized steel; also silicon bronze.

Send for free samples and Bulletin #577

THE PALNUT COMPANY
51 Glen Road
Mountainside, N. J.

PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

Chart Record

(Continued from page 114)

obtained from thermocouples, radiation detectors, or other devices which resolve variable into electrical signal. Up to six limit switches provided for high and/or low indications; up to four may have common front set.

Chart speeds range from 3 to 24 in. per hr, according to number of record points. Cross chart speed is 4 sec. Reported sensitivity is 5 μv for scale spans to 5 mv, 1/10 of 1% for larger spans. Accuracy is said to be $\pm$¼ of 1% for all spans in pyrometric range. Operates from 115-v, 50/60-cps line, with transformer available for 230-v use.
Wheelco Instruments Div, Barber-Colman Co, Rockford, Ill.

Photo Cell Calibrator

The series 6100 Calibrator is a portable bench or field unit for checking and adjusting the turn-on and turn-off points of photoelectric lighting controls. It includes a self-contained light measuring instrument and a variable intensity light source which is said to correspond to the blue portion of north sky illumination.

Photoelectric controls plug in to interchangeable mountings and adapters on a hinged front panel. Light values are read directly from meter calibrated in ft-c. A voltmeter and indicating lamps show operating points of control. Unit uses matched photocells and meter assembly. Standard model operates on 105 to 130 v, 60-cps ac; a special model is available for either 105 to 130 or 210 to 250 v operation.
Fisher-Pierce Co, Inc, 76 Pearl St. South Braintree, Boston 85, Mass.

More New Products

Stewart-Hall Chemical Corp, P. O. Box 66, Fleetwood Station, Mt. Vernon, N. Y. have an **aerosol degreaser** called Zipp for removing tar, carbon, oil, grease and similar materials from electrical equipment. Reportedly will not short equipment, leaves no film or vapor, is safe for painted surfaces, and is non-corrosive and non-flammable.

American Silver Co, Inc, 36-07 Prince St, Flushing 54, N. Y. is producing **Beryllium-copper strip,** said to be 100% free of surface oxides, for electrical, electronic and instrument manufacturers.

Automatic Switch Co, 391 Lakeside Ave, Orange, N. J., has a Bulletin 8222A **steam solenoid valve** for automatic flow control of steam, hot fluids, or gases in heat exchangers and industrial cleaning machines.

International Register Co, 2624 W. Washington Blvd, Chicago 12, Ill., offers a **time switch** which provides for presetting a different program of operations each day of the week. Designated Intermatic Series V21000.

Modern Power Sweeper Co, 738 N. McKeever Ave, Azusa, Cal. has an **electric power sweeper** for industrial and institutional use. Has a 36-in. swath and is said to cover 30,000 sq ft per hr.

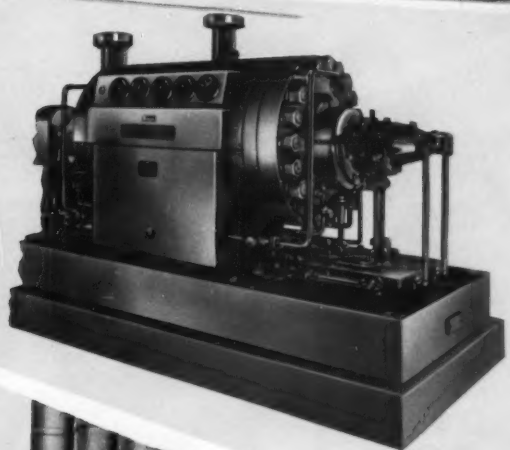
West Chester Chemical Co, Box 39, West Chester, Pa., offers a **plastic coating liquid,** Maintz, for coating buildings and equipment in corrosive atmospheres. Available in variety of colors.

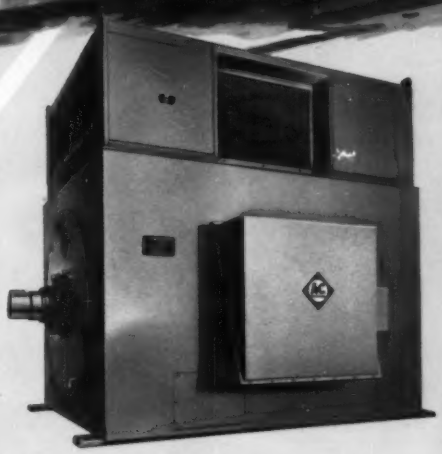
Rae Motor Corp, 2009 Kewaukee St, Racine, Wis., offers M-20 and M-100 **fractional-hp motors,** rated 1/30 hp continuous and operating from 6 to 220 ac/dc or dc shunt. M-20 is universal or shunt; M-100 is permanent magnet (d-c shunt).

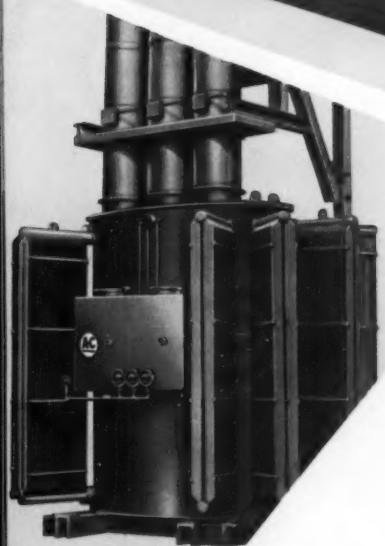
Western Electronic Products Co, 655 Colman St, Altadena, Cal., has a model B hot **wire stripper** which can remove vinyl, nylon, or polyethylene (but not Teflon or rubber) from a wide variety of wire sizes.

ALLIS-CHALMERS

Power House Auxiliaries







Built-Together, Work-Together Units

— that fit the modern standards of power house performance

Only Allis-Chalmers designs, builds, tests and applies *all* major station auxiliaries. This assures the utmost in integrated engineering and undivided responsibility . . . meets today's conditions of high load factor and continuous availability.

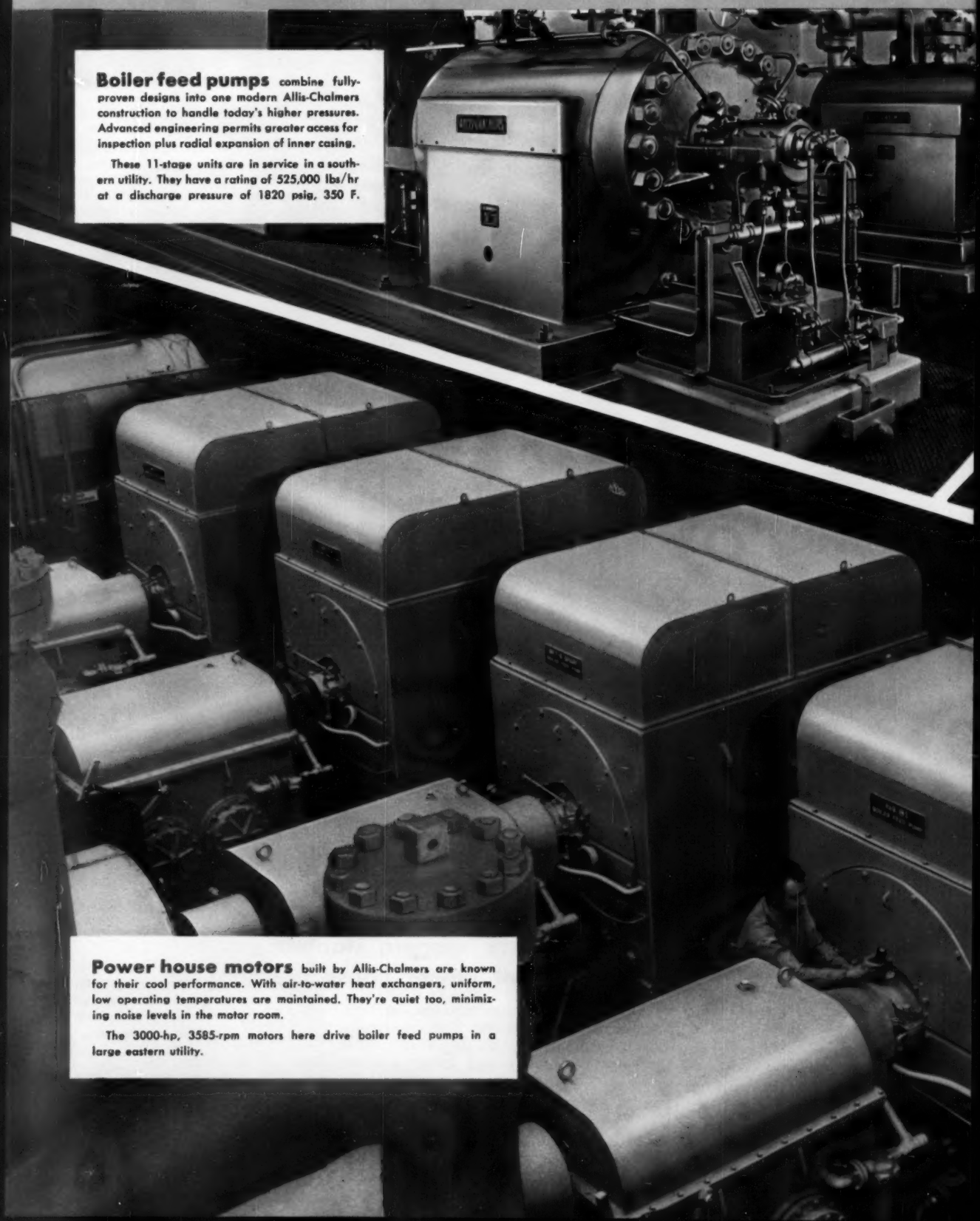
ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-5121

ALLIS-CHALMERS

Motors and Pumps—



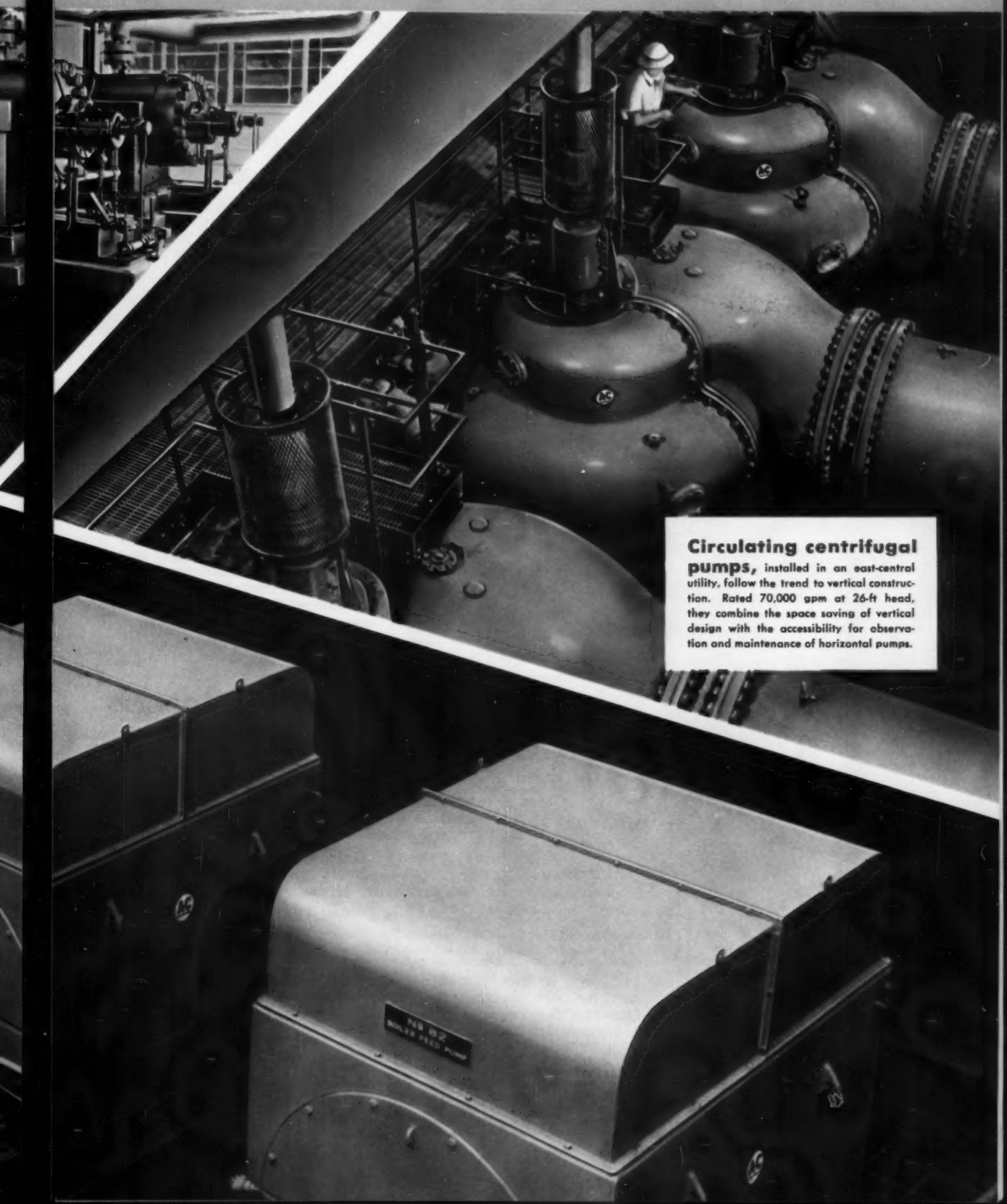
Boiler feed pumps combine fully-proven designs into one modern Allis-Chalmers construction to handle today's higher pressures. Advanced engineering permits greater access for inspection plus radial expansion of inner casing.

These 11-stage units are in service in a southern utility. They have a rating of 525,000 lbs/hr at a discharge pressure of 1820 psig, 350 F.

Power house motors built by Allis-Chalmers are known for their cool performance. With air-to-water heat exchangers, uniform, low operating temperatures are maintained. They're quiet too, minimizing noise levels in the motor room.

The 3000-hp, 3585-rpm motors here drive boiler feed pumps in a large eastern utility.

Proven by Installation

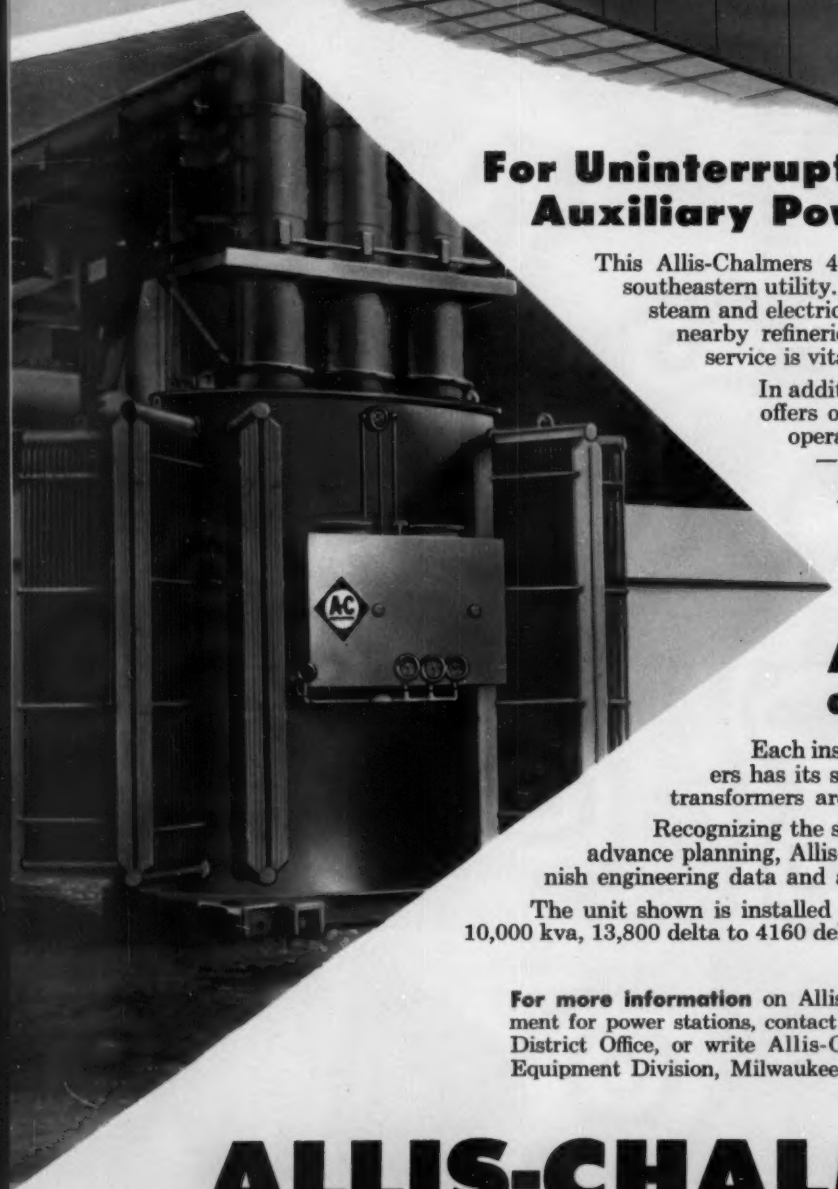


Circulating centrifugal pumps, installed in an east-central utility, follow the trend to vertical construction. Rated 70,000 gpm at 26-ft head, they combine the space saving of vertical design with the accessibility for observation and maintenance of horizontal pumps.

For Uninterrupted Auxiliary Power

This Allis-Chalmers 4.76-kv switchgear is installed in a southeastern utility. In addition to normal loading, both steam and electricity are supplied around the clock to nearby refineries by this station — continuity of service is vital!

In addition to dependability, this switchgear offers other advantages in installation and operation. On this job—as in many others — Allis-Chalmers engineers worked in close cooperation with both consulting engineers and utility engineers.



Balanced Design Assures Economy and Reliability

Each installation of station service transformers has its special requirements. Mass-produced transformers are not adequate for this application.

Recognizing the special requirements and the need for advance planning, Allis-Chalmers can be relied upon to furnish engineering data and approval drawings promptly.

The unit shown is installed in a West Coast utility. It is rated 10,000 kva, 13,800 delta to 4160 delta.

For more information on Allis-Chalmers equipment for power stations, contact your nearby A-C District Office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

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High Capacity
UNIT TEST BLOCKS

Write for Bulletin 81

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Wire Cap. #2 to 4/0

Test links interchangeable with service links, duplex screws on line side, solderless lugs with new type patented wire stop, barriers suitable for either side and extend ¼" over all live parts, large mounting holes in heavy duty molded base.

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CATALOGS—BULLETINS

● **SUBSTATION LIBRARY:** General Electric Co, Schenectady 5, N. Y., has issued seven publications which comprise a Unit Substation Silver Anniversary Technical Library. Publication No. and titles—

GER-1151, "Distribution Substations in System Planning"
GER-1299, "Economical Size Substations for 12-kv Distribution"
GER-1313, "Converting a Radial to a Primary Network Distribution System"
GET-2528, "Master Unit Substations and Their Relay & Control Arrangements"
GET-2677, "Integrating Substation & System Planning Requirements to Reduce Overall System Investment"
GEZ-1865, "Twenty-Five Years of Progress in Unit Substations"
GEZ-1867, "Use of Handbooks for Substation Planning Purposes".

● **'TEFLON' TUBING & ROD:** Heavy-walled tubing and rod of "Teflon" is covered in a 2-page bulletin, T-300, published by Haveg Industries, 900 Greenbank Road, Wilmington 8, Del. "Teflon" is Dupont's name for tetrafluoroethylene resin.

● **POLYETHYLENE CLOSURES:** A Fact File containing data sheets, samples, and price sheets on its line of CaPlugs (Polyethylene closures) for tubing, valves, hydraulic components, etc., is available from CaPlugs Division, Protective Closures Co, Inc, 2207 Elemwood Ave, Buffalo 23, N. Y.

● **SHAPE CUTTING MACHINE:** Advantages and applications of Airco's No. 4 Monograph portable shape-cutting machine are described in an 8-page catalog issued by Air Reduction Co, Inc, 150 E. 42nd Street, N. Y.

● **ALUMINUM STRIP CONDUCTOR:** Reynolds' aluminum interleaved strip conductor, its design, applications and advantages, are covered in a brochure published by Reynolds Metals Co, 4500 South Third Street, Louisville 1, Ky.

● **ELECTRONIC COMPONENTS:** The line of electronic components manufactured by Freed Transformer Co, Inc, is featured in a 48-page catalog. Write the company at 1718P Weirfield Street, Brooklyn 27, N. Y.

● **AIR TOOLS:** A catalog illustrating its line of air tools has been published by Thor Power Tool Co, Aurora, Ill.

● **SPECIAL-PURPOSE DC MOTORS:** Engineering data on its line of special-purpose "Series 2000" dc motors has been published by Induction Motors Corp, 570 Main Street, Westbury, L. I., N. Y.

● **RLM INDUSTRIAL LIGHTING SPECS:** A 36-page booklet, containing the standard specifications for industrial units made by member companies of Reflector and Lighting Equipment Manufacturers Assn has been issued by RLM Standards Institute, 326 W. Madison Street, Chicago 6, Ill.

● **CABLE INSULATING & JACKETING COMPOUNDS:** Bakelite Co has issued an 18-page catalog on its vinyl wire and cable insulating and jacketing compounds covering a wide range of wire applications and materials. Write Bakelite Co, 30 E. 42nd Street, New York 17, N. Y.

AIR POLLUTION HANDBOOK

JUST PUBLISHED! Brings together in readily available form useful information on the major aspects of the air pollution problem. Discusses causes, effects, and control in chapters covering the science of air pollution, the effects on plants and animals, and the various corrective techniques. **Edited by Paul Magill, Francis Holden, and Charles Ackley, all of Stanford Research Inst. 672 pp., illus., $15.00**

ELECTRICAL SYSTEMS DESIGN

JUST OUT! Brings you a *complete picture* of all that is best in modern practice in the design and layout of electrical systems for power, light, heat, signal systems, and communications. Shows how to select apparatus of the right type, size, appearance or rating; how to work with the architect; how to design lighting systems scientifically, etc., etc. By J. F. McPartland and Editors of Elect. Const. and Maint. 140 pp., illus., $6.00

PRACTICAL ELECTRICAL WIRING

JUST OUT! New 5th Edition. Based on 1956 National Electrical Code. Practical methods of electrical wiring, explained in plain, easy language. Provides hundreds of on-the-job tips and short-cut suggestions. Tells how to do all kinds of light and power wiring (under 600 volts) on the farm, and in homes, factories, stores, schools, etc. **By H. P. Richter, Member, Int'l Assoc. of Elect. Inspectors. 602 pp., 468 illus., $6.75**

HOW RATES ARE SET

Thorough, practical guide to economic and technical factors of electric utility rate making. Gives fundamentals of electric utility business; discusses theoretical basis of price structure and tariff, engineering economics and cost analyses, the rate department, earnings, utility plant, depreciation, rate of return, etc. Detailed methods; many data. **Electric Utility Rate Economics.** By R. E. Caywood, Mgr. of Rates, West Penn Power Co., 248 pages, illus., $10.00.

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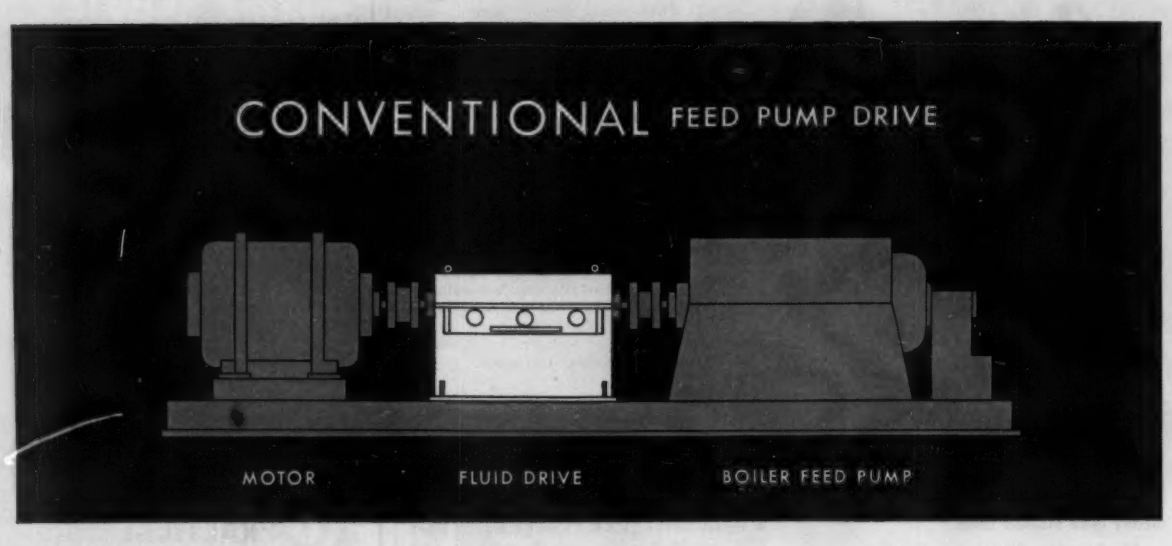
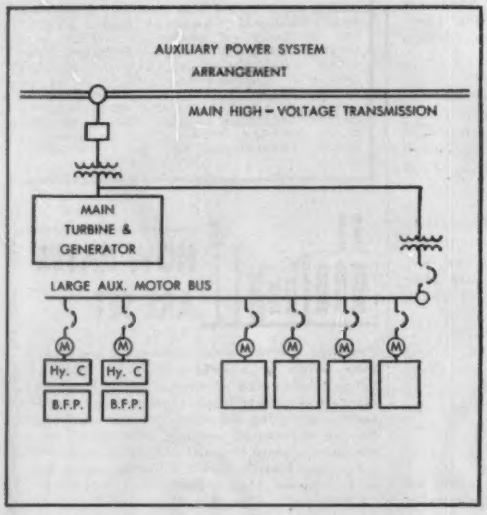
How *Gýrol*® Fluid Drive meets all

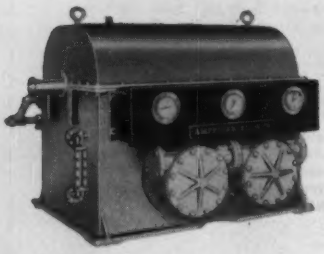




Of all power-plant auxiliaries, the boiler feed pump consumes the greatest single segment of invested power. To release more of this power to consumer lines, power plants of all sizes are controlling feed water flow by speed regulation through Gýrol Fluid Drive – driven by a constant speed prime mover.

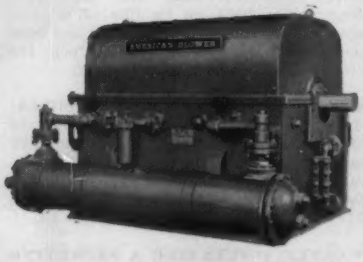
Gýrol Fluid Drive offers several specific advantages:

1. It saves power over the entire operating range by eliminating wasteful throttling by valves.
2. Fluid Drive's adjustable-speed feature permits reduction in pressure – resulting in further power savings.
3. It reduces wear on bearings, and other vital pump parts, by letting the pump operate at speeds that fit boiler demands.
4. With Fluid Drive, paralleling of pumps is simplified. Change-over from operating to standby pump is quick and easy.
5. Quiet operation is inherent in the design of Fluid Drive, since a "cushion of oil" is the means of energy transmission.



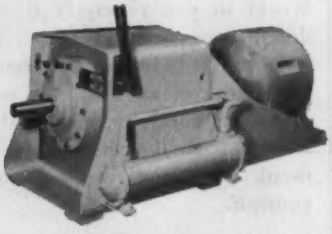
TYPE VS CLASS 6

- adjustable speed control
- 250 to 12,000 horsepower
- speeds to 3600 rpm



TYPE VS CLASS 4

- adjustable speed control
- 100 to 2500 horsepower
- speeds to 1800 rpm

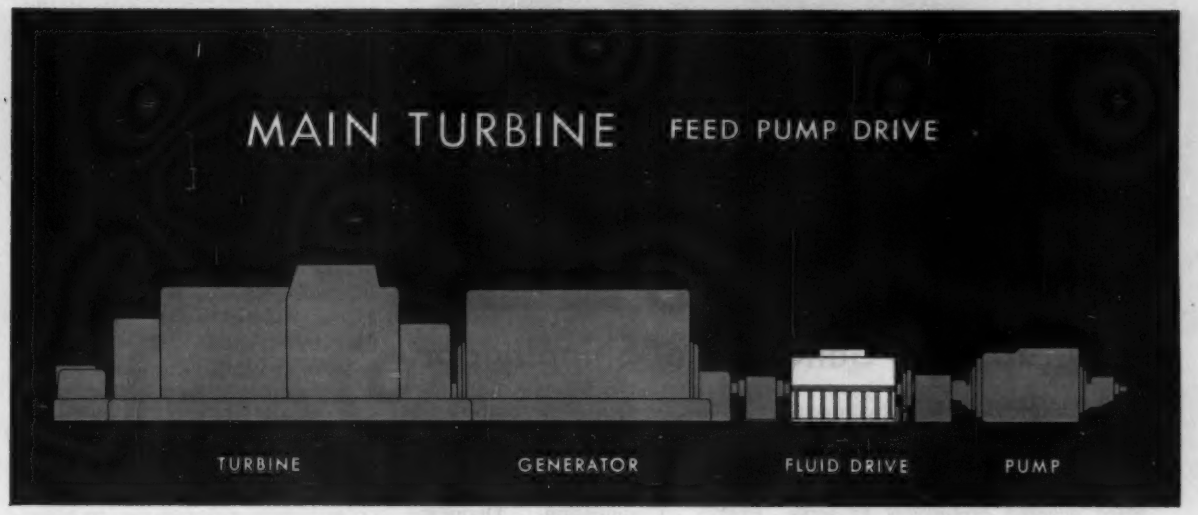


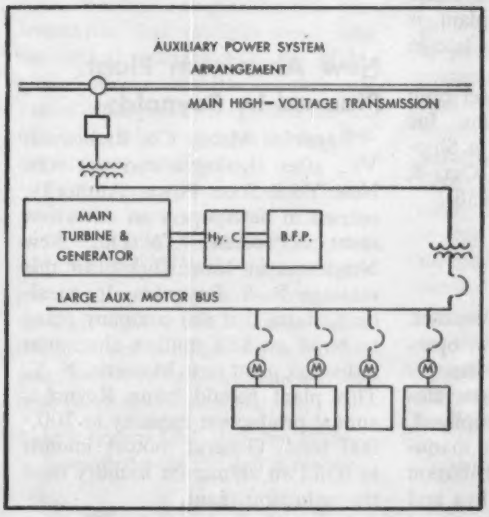
TYPE VS CLASS 2

- adjustable speed control
- 1 to 800 horsepower
- speeds to 1800 rpm

requirements for feed pump control

Regardless of station size, arrangement, or prime mover, you get the advantages of power savings, reduced pressures, and quiet operation with American Blower Gýrol Fluid Drives





Already in the construction stage is the use of Gýrol Fluid Drive for main turbine feed pump drives on some of the largest generating units yet projected.

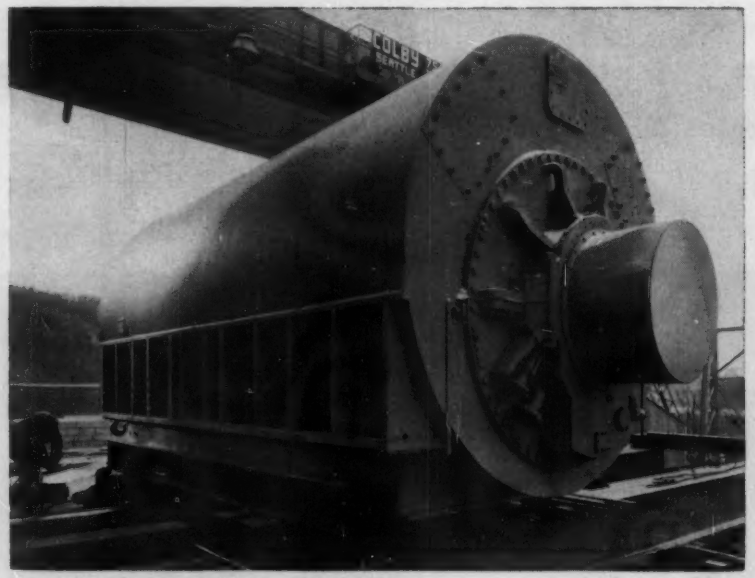
For example, two of these stations will each drive, through a 12,000-hp adjustable-speed Gýrol Fluid Drive, the main feed pump from the high-pressure turbine. Full boiler capacities will be supplied by the single 5-stage pump, each delivering 6330 gpm against 6400 feet total discharge head when operating at 3510 rpm with feed water at 363° F.

Each pump requires an excess of 11,000 hp, and will be driven from the generator shaft through an adjustable-speed Gýrol Fluid Drive.

In your plans for expansion, why not discuss the advantages of Gýrol Fluid Drive with an American Blower engineer. His knowledge of this application in modern power plants may prove valuable to you. Call our nearest branch, or write: American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

AMERICAN BLOWER

Division of AMERICAN-Standard



Install 100 Mw Generator at Shippingport

This 100,000-kw, hydrogen-cooled generator is being installed at Shippingport, Pa., site of the world's first atomic electric power plant devoted exclusively to serving civilian needs. The generator, weighing 203 tons and having an over-all length of about 29 ft was manufactured at East Pittsburgh works of Westinghouse Electric Corp. It will be direct-connected to a steam turbine, which is expected to arrive this month. The turbine-generator will be installed in the open, without walls or roof, and will be the first outdoor installation in that part of the country.

Westinghouse is developing and building the plant's nuclear reactor under contract to the U. S. Atomic Energy Commission. Duquesne Light Co of Pittsburgh is building the electric generating part of the plant, and will operate the entire plant. The Shippingport plant is expected to be in operation late in 1957.

The 235-ton reactor vessel built by Combustion Engineering Inc was placed in its container at Shippingport last autumn (EW, Oct. 8, 1956, p 52; Nov. 5, 1956, p 56).

American Gage Acquires Standard Transformer Co

Purchase of Standard Transformer Co, Warren, Ohio, by American Gage & Machine Co, Chicago, was made known in a joint statement by Wallace F. Carroll, president of American Gage, and Worthington F. Parker, retiring president of Standard Transformer. Carroll also announced the appointment of Chester F. Buckley, member of a consulting engineering firm, as president and general manager of Standard Transformer. Conditions of purchase are unrevealed.

Standard Transformer will operate as a separate unit. No changes in personnel, products, or sales policy is reportedly contemplated. Established in 1919, the firm manufactures power and distribution transformers up to 10,000 kva and 66 kv, and a line of control and instrument transformers.

American Gage operates Simpson Electric Co, Chicago, manufacturer of meters; Walsh Press & Die Co, Chicago; Batavia Body Co, Batavia, Ill.; and Size Control Co, Chicago.

Delta-Star Develops Vacuum Interrupter Switch

A vacuum tube interrupter switch is a development of a disconnect switch on which tests have been completed recently by Delta-Star Electric Division of H. K. Porter Company, Inc. The interrupter switch is designated type JV. It consists of a series of vertically stacked vacuum tube switches and the company's conventional MK40 disconnect switch. Ratings up to 230 kv are reported obtainable.

When the MK40 switch is closed current is carried through in the usual manner. In the opening operation, the MK40 blade lifts a flipper arm of the interrupter, establishing a current path through the vacuum switches; then opens the vacuum tube contacts, interrupting the circuit; and later closes the vacuum switches. The open circuit is maintained because of the large gap between the blade and vacuum switch column.

In the closing operation, the circuit is re-established between the blade and arcing contact. This relieves the vacuum switches of carrying heavy inrush currents.

New Aluminum Plant Planned by Reynolds

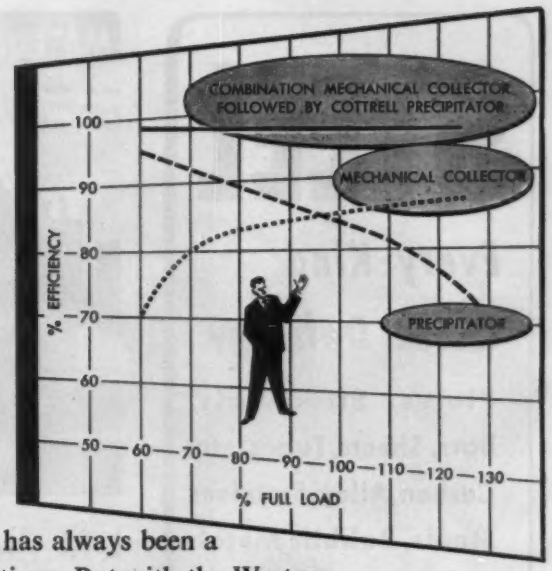
Reynolds Metals Co, Richmond, Va., after signing a contract with New York State Power Authority, carried in newspapers an advertisement addressed "To Our New Neighbors in New York". In this message R. S. Reynolds, Jr, president, states that the company plans to build an $88 million aluminum reduction plant near Massena, N. Y. This plant should bring Reynolds annual production capacity to 700,000 tons. General motors intends to build an aluminum foundry near the reduction plant.

It is estimated that for this new Reynolds project $30 million of construction cost will be spent locally. Also annual expenditures in New York by the Reynolds plant are estimated at about $21 million.

(More M&M on page 126)

Advantages of the Western Precipitation CMP Unit

for recovering fly ash in power plant operations



The control and recovery of fly ash has always been a troublesome problem in power plant operations. But with the Western Precipitation CMP unit, new economy and efficiency in the solution of fly ash problems are now being made in both small and large plants.

The CMP is backed by experience unequalled in the industry. Almost a half century ago Western Precipitation pioneered the first commercial application of the now-famous Cottrell Electrical Precipitator to recover suspensions *electrically*, and this equipment is still unsurpassed in its field.

Subsequently, to provide efficient fly ash recovery for low cost installations, Western Precipitation also pioneered the first multiple small tube mechanical recovery unit—the Multiclone Collector—and this unit promptly gained widespread recognition for the new efficiencies it brought to mechanical recovery processes.

From these years of experience gained in *both* electrical (Cottrell) and mechanical (Multiclone) recovery installations, Western Precipitation pioneered another new development—the CMP Unit—*a unit that combines in one compact installation many of the best features of both electrical and mechanical recovery methods.*

In a typical CMP Unit, the stack gases first pass through a Multiclone section where the heavier materials are removed *mechanically*.

The partially-cleaned gases then pass through a Cottrell section where the very small particles are removed *electrically*.

This arrangement offers several important advantages. Removing the heavier particles by Multiclone permits the bulk of the recovery operation to be performed with relatively low-cost equipment. Using a Cottrell for the final clean-up insures unusually high recovery efficiency—approaching theoretically perfect, if desired. Thus, the CMP combines high recovery efficiency with low total cost.

But that's not all. The CMP has the further advantage that the efficiency curve of the Multiclone portion complements that of the Cottrell portion (as shown in the chart above)—*therefore the overall CMP efficiency remains practically uniform at all boiler loads.*

At low boiler loads the recovery efficiency of the Cottrell is highest . . . and at high boiler loads the Multiclone reaches its maximum efficiency. But, by combining the two types of equipment into a *single* CMP Unit, the efficiency curve remains almost flat, regardless of the boiler load.

With CMP equipment, even small power plants can now afford adequate fly ash recovery. However, this fact is all-important . . . full benefit of the CMP principle can be obtained only by a proper balance between the mechanical and electrical sections to fit the individual requirements of *each individual* installation. And no organization is better equipped to provide this critical "know-how" than the *one* organization that has had far more experience than any other in BOTH *electrical* and *mechanical* recovery methods . . . WESTERN PRECIPITATION CORPORATION!

This, the industry's finest recovery experience, is as close to you as your telephone. May we supply further details?

COTTRELL Electrical Precipitators
MULTICLONE Mechanical Collectors
CMP Combination Units
DUALAIRE Reverse-Jet Filters
HOLO-FLITE Processors

Western Precipitation Corporation

Designers and Manufacturers of Equipment for Collection of Suspended Materials from Gases

Main Offices: **1004 WEST NINTH STREET, LOS ANGELES 54, CALIFORNIA**

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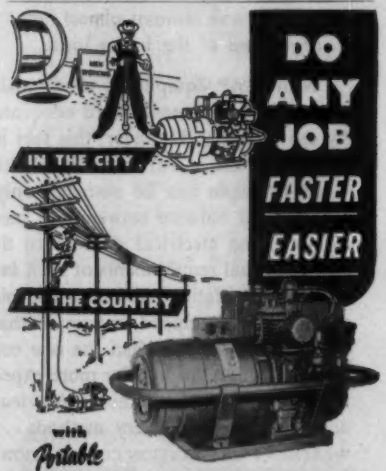

with Portable

Katolight A.C. POWER

No matter where or what the job, a Katolight Portable Power Plant will simplify and speed up construction or maintenance work by supplying quick dependable electrical power right on the spot. Operates blowers, heaters, drills, hammers, saws, soldering irons, other portable electrical tools and equipment. Eliminates power line hookups.
Gasoline models from 350 Watt to 50 K.W. D.C. models 500 watt through 15 K.W. in standard voltages for portable, continuous or standby service.

IT'S NEW! SEND FOR FREE FOLDER ON NEW LIGHTWEIGHT PORTABLE MODELS

Katolight CORPORATION
Box 891-116, Mankato, Minnesota

L-M Progress Shown Through Patents

"Continuity of Progress Requires Continuity of Electric Power" was the theme of the Line Material Industries' Patent display at the U. S. Patent Exhibit in Washington, D. C. The recent exhibit acquainted the public with the function of the U. S. Patent System to encourage and protect inventions. Line Material Industries, McGraw-Edison Co, was one of 20 companies invited to participate in the exhibit.

Line Material showed the evolution of its oil circuit recloser. This device has four successive interrupter inventions, each protected by patents. For 22 years it has contributed to service continuity of distribution systems.

The display also presented L-M's 46 years of progress as a manufacturer of transmission and distribution line equipments, street and airport lighting equipments, and biluminized fibre products.

Seen at the exhibit were Secretary of Commerce Sinclair Weeks (right center) and Commissioner of Patents Robert C. Watson (left center) discussing oil circuit reclosers and patents held by Line Material Industries with L-M Vice Presidents Clark Hazelwood (left) and Earle Williams (right).

GE $9 Million Expansion Under Way at Lynn Plant

General Electric's largest of four divisions at Lynn, Mass., the medium steam turbine, generator and gear department, is expending this year $9 million in new facilities. Armand T. Chandonnet, department general manager, states that two new buildings are nearing completion. One will house engineering, drafting and administrative personnel, and the other a manufacturing bay with new machine tools and 200-ton cranes. The latter will allow the department to build turbines and generators of 60,000 kw and larger. Both building projects are scheduled for completion and occupancy by midyear. Previous maximum sizes of generating units produced at Lynn has been about 44,000-kw.

While a large part of the department's production has been for marine and naval use, including gears for craft propulsion, utilities and industrial plants have been customers as well.

A general shortage of available skills in large machine tools and heavy fabrications has been an important influence in GE training costs. These increased here by $500,000 in 1956 and an employment rise of 1,000 people has already taken place. The training budget is expected to rise about $550,000 this year. Recently a new $1-million materials and process

(Continued on page 128)

NO MEASURABLE ERROR IN A 5 OERSTED FIELD!

Model 325 self-shielded D-C Laboratory Standard (1/10 of 1%)—an improved instrument now replacing the world renowned Model 5.

The new Weston model 325 provides a new STANDARD of laboratory measurement

Another WESTON first... a self-shielded primary instrument standard that is unaffected by magnetic fields normally encountered in the modern laboratory. While the new Model 325 incorporates a special CORMAG® mechanism, the overall design provides an even far greater degree of shielding than that inherent in the basic core-magnet mechanism. In fact, tests show absolutely no measurable error in a 5 oersted field. Thus there is no need for positioning or mounting the instrument with reference to the earth's field; nor to take undue precautions when using it in close proximity to current carrying conductors. In addition, Model 325 is well compensated for normal room temperatures; and a vernier type corrector is provided for precise and rapid zero adjustment. This improvement in primary instrument standards is another example of the *forward thinking* and *continuous development* which have kept WESTON the instrument leader since 1888. For complete data on Model 325, or on other Weston instruments consult your nearest Weston representative, or write... *Weston Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, N. J.* A subsidiary of Daystrom, Incorporated.

WESTON
Secondary Standards
(¼ of 1%)

WESTON *Instruments*

The editor is waiting to see you . . .

Whatever you find between the covers of ELECTRICAL WORLD is there for only one reason . . . because you want it. Our staff of 22 full time journalists are responsible only to you for whatever they put in your magazine. And that's as it should be, because it's you and WORLD's 26,000 other subscribers who know the varied and complex needs of the electric power industry. And you've shown your confidence by consistently rating Electrical World at the top of your reading-preference list.

If you'll just glance back over the years, you'll see how solidly we've dedicated ourselves to your service . . . adding new editors, more color, better layout, illustrations. Whole new departments have appeared as the need arose . . . finance, public relations, government regulations, sales problems, plus the most complete coverage and interpretation of the news you'll find in the industry. The one yardstick is still its usefulness to you, because actually, *you are the editor.*

ELECTRICAL WORLD

330 W. 42nd St., New York 36, N. Y.

GE $9 Million Expansion

(Continued from page 126)

laboratory has been added to the department.

The U. S. Navy has awarded General Electric a $4,084,090 contract for propulsion turbines, gears and other equipment to drive the first atomic powered naval cruiser.

Alcoa Introduces New Poly-Covered Conductor

A polyethylene-covered aluminum conductor has bowed in as the latest product designed for the electrical field by Aluminum Co of America. In announcing the development, Alcoa added that a new covered-conductor department at its Massena, N. Y., works is in full operation. This is the first time the company has fabricated its own line of conductor covered with polychemicals.

The facility's equipment will cover single wires and stranded conductors in a wide range of sizes, Alcoa said.

M & M BRIEFS

Fargo Mfg Co, Poughkeepsie, N. Y., has an automatic deadend to reduce installation time on spool terminations, for conductor sizes No. 8 to 250 Mcm.

I-T-E Circuit Breaker Co, Philadelphia, Pa., has acquired Walker Electrical Co, Inc, Atlanta, Ga., on a stock exchange basis. Latter will continue to manufacture fusible entrance service and distribution equipments and meter boxes for residential and commercial installations.

Automatic Switch Co, Florham Park, N. J., telephone FRontier 7-4600, is the new address and telephone number for this manufacturer of automatic transfer switches, electromagnetic control and solenoid valves.

Allis-Chalmers Mfg Co has reported the sale of the earth drill business of the Buda Division to Mobile Drilling, Inc., Indianapolis, Ind.

For a Contact– or a Complete Sub-Assembly... See Mallory

Mallory offers you the savings and convenience of a single source for a simple contact —or a complete contact sub-assembly.

As Mallory has done for many manufacturers, we can consult with your engineers on a contact problem—solve the problem—design the contact element for easy inclusion in an assembly—and, if you want, build the entire sub-assembly for you.

Into this service goes all of Mallory's long experience in the contact field. Mallory metallurgy has equipped them with the best of materials and know-how, for the contact itself—for the backing metal—for design of the housing and for assembly techniques.

The pictured assembly was designed in cooperation with a leading electrical equipment manufacturer. The contacts, conductors, terminal points and the molded plastic case are all cooperative products of Mallory and the customer's engineering and manufacturing abilities. The contact material, Mallory D-54®, permitted the customer's product to pass Navy tests—and at the same time reduced costs by 15%.

So if yours is a contact problem—or a complete contact sub-assembly problem—bring it to Mallory. A single source can expedite your supply and minimize your scheduling problems. Write, or contact the Mallory representative—today, for literature or a consultation.

Expect more...get more from

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Serving Industry with These Products:

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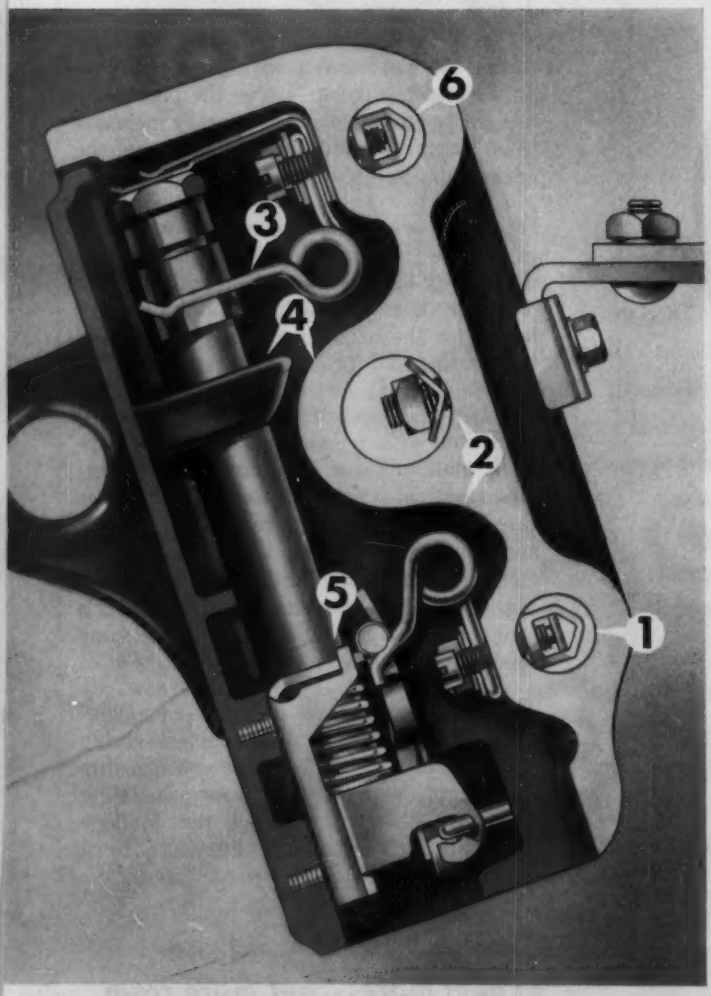
Metallurgical — Contacts • Special Metals • Welding Materials

These are the cutouts linemen prefer...

KEARNEY TRIPOMATIC

ENCLOSED CUTOUTS

Check these KEARNEY Tripomatic features . . . each developed and tested to provide the most dependable protection for your distribution equipment.



1. A porcelain wall *isolates* lead-in holes for back connected terminals from the cartridge chamber.
2. Parts fastened with bolts extending through housing . . . cemented attachments eliminated. Contacts and hanger bracket *can't* loosen or pull out of housing.
3. When fuse link blows, resilient spring contacts absorb impact of tube recoil, preventing shock damage to entire cutout. Since the contacts *remain* in adjustment, high contact pressure is maintained even after long service.
4. Engineering of box interior and the collar around the tube restricts gas movement from lower to upper contact. Internal short circuits are prevented.
5. Positive dropout through spring backed toggle mechanism.
6. Fully plated stirrup type terminals. 50 amp. cutouts take No. 2 str.; 100 amp. ratings take No. 2/0 str.

FIELD-TESTED—At KEARNEY's Substation Laboratory of 150,000 KVA Transformer capacity—with a back up power of 445,000 KVA—all equipment is tested under rigorous field conditions. KEARNEY Certified Ratings are actual, proved performance ratings . . . not just theoretical calculations.

for BETTER CONSTRUCTION
SAFER MAINTENANCE
Specify

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. GUELPH, ONT.

The Mark of Quality

KEARNEY PRODUCTS

they're easiest to fuse...

No nuts, no bolts to tighten! Exclusive construction of the KEARNEY Tripomatic makes it the fastest, easiest cutout to fuse.

Here's how simple it is:

Thread standard buttonhead fuse link through cartridge, and tighten cap . . .

Snub the fuse link cable *over and around* the toggle . . .

Pull cartridge back against its stainless steel spring until toggle arm drops in place over lug, locking fuse cable in place. Mechanical breakage is prevented because correct tension is placed on every fuse link!

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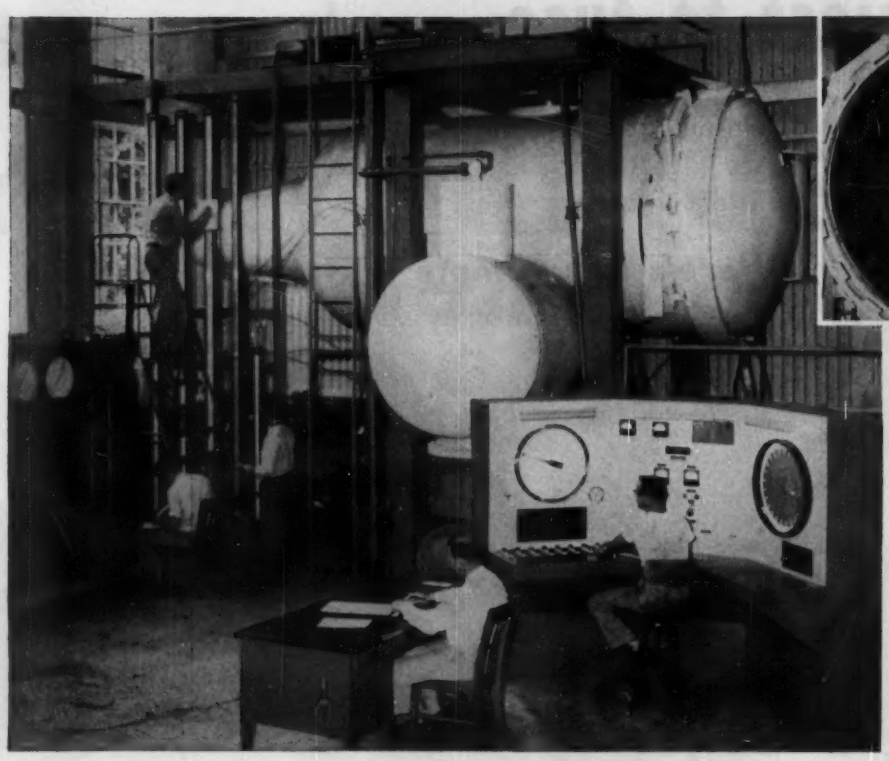
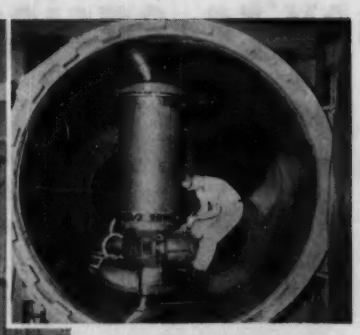




A complete model turbine wheel case assembly, built to extreme accuracy, is shown being mounted in the testing chamber.

New high head test stand in the SMS Hydraulic Laboratory, including control panel and gages.

High Head Turbine Test Stand At SMS Laboratory DUPLICATES FIELD CONDITIONS

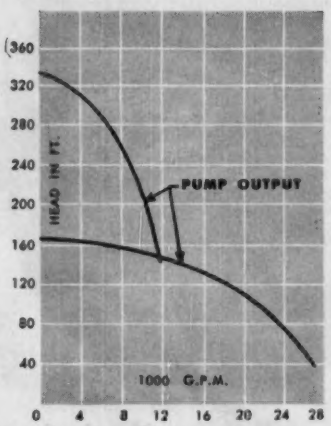
With the addition of its new high head test stand, the SMS Hydraulic Laboratory can now test homologous model turbines under controlled conditions that *duplicate* those found in the prototype installations. This is a substantial stride forward in hydraulic turbine research, since the complete reproduction of actual field conditions has not previously been possible.

The outstanding features of this new facility are:

- World's highest artificial testing head.
- Flows of 5,000 g.p.m. under 300-foot head, and 21,000 g.p.m. under 100-foot head.
- 300 H.P., 0 to 6,000 R.P.M., eddy current dynamometer.
- 100-ton water cooling system to maintain prototype water temperature.

Both basic research and formal contract acceptance tests are performed here. Test stand equipment permits testing of all Kaplan and Propeller, as well as many Francis turbine designs, under conditions of *head* and sigma that *duplicate* those found in the field. This provides a high degree of testing accuracy and permits accurate testing of settings that cannot be satisfactorily field tested.

For further information on the significance of this high head test stand, write to S. Morgan Smith Co., York, Pa.



Pump Head-discharge Curves for Series and Parallel Operation.

S. MORGAN SMITH

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

HYDRAULIC TURBINES · PUMPS · GATES & HOISTS · TRASH RAKES · LIQUID HEATERS

HYDRODYNAMICS

ROTOVALVES · BALL VALVES · BUTTERFLY VALVES · FREE DISCHARGE VALVES · CONTROLLABLE-PITCH SHIP PROPELLERS

ELECTRICAL BUSINESS OUTLOOK

Electrical World
MARCH 18, 1957

An inventory recession is not in the offing, even though manufacturers' stocks of raw materials and finished goods are higher now than ever before in business history. Concern over a recession always rises when inventories rise faster than sales. And they did last year. The inventory-to-sales ratio now stands at 1.8 compared with 1.7 a year ago.

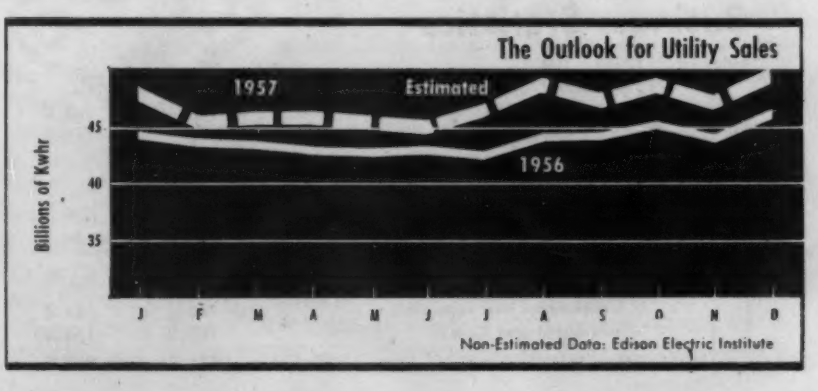
The situation now is not strictly comparable with the recession of 1953-54. Then businessmen built up stocks because they anticipated large government orders and heavy purchases of manufactured goods by consumers. When orders failed to come through, they had to trim stocks by cutting production and their own buying until the sales-inventory ratio looked better. Now about ⅓ of the $5.5 billion inventory increase reported by the Commerce Department represents price increases rather than accumulation of materials and finished goods.

Nearly ⅔ of the inventory increase is in industries that are on a rising tide of sales this year. Machinery manufacturers added most heavily to stocks. They have heavy backlogs of orders and are picking up new ones faster than a year ago. Both chemicals and petroleum added substantially to inventory, but are apparently headed for a record sales year. Inventory accumulation in the transportation industry was heavy. But only a little showed up for autos; most of it appears for other types of transportation equipment where there are heavy backlog of orders.

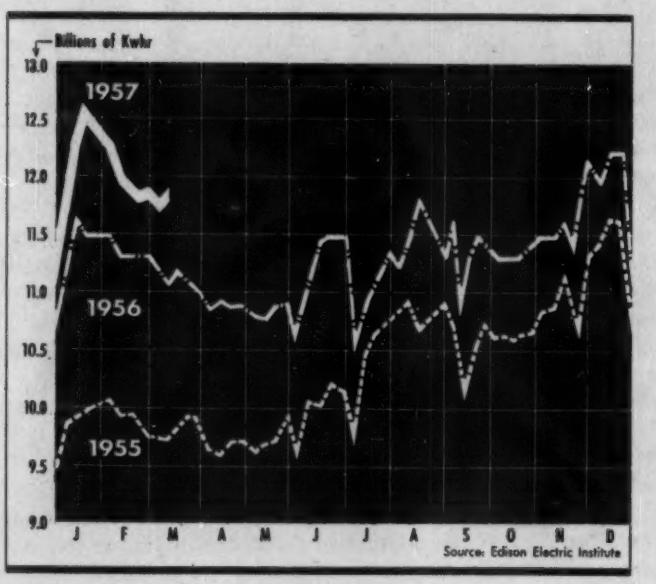
Appliance stocks would not be affected much even if an inventory cutback did materialize. For some months now manufacturers have been cutting back production. This can be seen in the National Electrical Manufacturers Association's monthly index of manufacturers sales. For the sixth straight month the index has declined. January sales were 96% of the 1947-49 average, a drop of 8.6% from January of last year. This, in turn, was down 2.9% from the boom year of 1955.

A good part of the gloomy appliance picture can be traced to the continued downturn of housing starts. Observers now feel housing starts will dwindle to one million or less this year, mostly due to the tight money factor.

Firming interest rates probably will not help the home building industry much if Congress keeps the 4½% lid on Veterans Administration interest rates. However, the picture could change if Congressional leaders backed the builders proposal to reduce Federal Housing Administration down payments. This could take up the slack caused by the downturn in VA mortgage grants.



STATISTICS



OUTPUT
Week ended March 9, 11,867,000,000 Kwhr Up 6.6%

Per Cent Change From Previous Year

	Feb. 23	Mar. 2	Mar. 9
Total U. S.	+ 5.7	+ 5.3	+ 6.6
New Eng.	+ 4.8	+ 3.9	+ 3.3
Mid. Atlan.	+ 3.3	+ 3.1	+ 4.0
Cent. Ind.	+ 6.0	+ 6.5	+ 7.1
West Cent.	+ 9.2	+ 9.1	+ 9.7
Southeast	+ 7.4	+ 5.9	+10.8
South Cent.	+10.8	+11.9	+10.3
Rocky Mount.	+ 8.5	+ 2.5	+ 7.0
Pacific			
NW	− 2.9	− 4.9	− 4.7
SW	+ 4.2	+ 6.0	+ 4.2

Seasonally Adjusted Index 227.7
Week Ago 225.5
Year Ago 213.2

Atomic Energy Commission requirements—1,150,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 7.1%.

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Dec.	120.44	119.91	114.47	5.2
Peak—Class 1 Systems (million kw)	Dec.	102.8	101.2	98.3	4.6
Estimated Dec. '57 Peak	Dec.	114.5	114.8	112.6	1.7
Production—billion kwhr	Dec.	52.88	50.65	50.82	4.1
Hydro		10.00	9.31	9.34	7.1
Fuel		42.88	41.34	41.48	3.4
Sales—billion kwhr	Dec.	47.46	45.78	45.15	5.1
Residential		13.22	11.66	12.31	7.4
Commercial		7.34	7.20	6.80	7.9
Industrial		24.44	24.51	23.70	3.1
Other		2.47	2.41	2.33	6.0
Fuel Consumption	Dec.				
Coal—million tons		14.73	14.03	14.81	−0.5
Oil—million barrels		8.22	7.13	8.55	−3.9
Gas—million cu ft		82.17	88.73	69.85	17.6
Net Income Class A & B Co's— $million	Dec.	132.82	102.54	124.95	6.3
Residential Customers—millions	12 mos.	45.71	45.62	44.41	2.9
Revenue per kwhr	ended	2.60¢	2.60¢	2.64¢	−1.5
Avg kwhr per customer	Dec. 31	2,969	2,942	2,751	7.9
Avg annual bill		$77.19	$76.86	$72.63	6.3

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Jan.	145	144	143	1.4
ENR Construction Cost	Mar.	148.6	148.9	142.6	4.2
BLS Cost-of-living	Jan.	118.2	118.0	114.6	3.1
New Orders for Machinery (1950 = 100)	Jan.	152	138	135	12.6
NEMA Sales					
Insulation materials	Jan.	154	139	159	−3.1
Electric appliances		96	84	105	−8.6
Wholesale prices	Dec.				
Motors and generators		140.6	140.1	126.5	11.1
Transformers and regulators		146.6	146.6	131.2	11.7
Switchgear and fuses		163.9	164.4	147.5	11.1
GNP—annual rate—$ billion	4th Qtr.	423.8	413.8	397.3	6.7

MANAGEMENT BULLETIN

FINANCE

Security offerings of electric utilities came in heavily last week. Three of the larger electric holding companies were in the market for $74 million of common stock money. Before the week was over a total of around $160 million of new securities were being offered to the public as follows:

On March 11 a group of underwriters headed by Shields & Co and Equitable Securities Corp won an issue of $12 million Minnesota Power & Light Co first mtge 4¾% bonds (A) due 1987 with a bid of 101.759%; reoffered at 102.75% to yield 4.58%. Issue reported "moving along." . . . General Public Utilities Corp is offering rights to its stockholders to subscribe to 646,850 common shares on a 1-for-15 basis, record March 8 to expire March 29 at $32 a share.

On March 12 First Boston Corp group won $55 million Commonwealth Edison Co first mtge 4¼% bonds (Aaa) due 1987 at 99.38%; reoffered at 100% to yield 4.25%. Issue reported "going very well." . . . Blyth & Co and Harriman, Ripley & Co group won 600,000 common shares of Central & South West Corp with a bid of $35.80 a share; reoffered at $36.75 a share. Issue reported "going well." (For latest financing see p 19.)

Common stock dividend payments continue to increase. California-Pacific Utilities Co will pay 40¢ a share a quarter now as compared with 37½¢ previously . . . Hawaiian Electric Co pushed its dividend to 57½¢ versus 55¢ in the previous quarter.

Privately owned Class A and B electric utilities increased net income by 6.3% in December over a year ago, Federal Power Commission reports.

Offerings that will come to the market soon are: 34,352 common shares of Black Hills Power & Light Co; about 600,000 common shares of Philadelphia Electric Co; $6 million first mtge bonds of New Orleans Public Service; $29 million first mtge bonds of Appalachian Electric Power Co; 214,100 common shares of Savannah Electric Power Co, and 665,760 common shares of Houston Lighting & Power Co.

CONSTRUCTION

Utilities are announcing large expansion plans. Jersey Central Power & Light Co plans to spend $24.2 million in 1957 and about $25 million each year for the next three years; Central Power & Light Co, $125 million during the next five years; St. Joseph Light & Power Co, $4.7 million this year; Appalachian Electric Power Co, $56.4 million in 1957; Union Electric Co, $330 million in five years; Bonneville Power Administration, about $6 million in 1957; Public Service Electric & Gas Co, $310 million in 1957, and Cleveland Electric Illuminating Co, $46 million in 1957.

ANNUAL REPORTS

Annual reports are now coming in at a fast clip. Atlantic City Electric Co had a good cover showing the area served. The report was colorful and the charts were excellent . . . Boston Edison Co also had good charts with one of them showing "Income and Outgo" of the revenue dollar for 1956 . . . Central Illinois Light Co used color to good advantage . . . California Oregon Power Co. has an excellent "Code of Business Ethics" as you open the report. The report is very readable, pictures interesting, and not too elaborate . . . Hartford Electric Light Co used the 75th anniversary theme. Cover is plain and simple. It also sent out a "Historical Review" of the company for its anniversary . . . Home Light & Power Co has a page on employees activities . . . Interstate Power Co has a colorful report with a theme "Balanced Economy of Interstateland . . . Our Key to Progress." Report has a good two-page area served map . . . Iowa-Illinois Gas & Electric Co features photographs of its various committees . . . Kansas Power & Light Co shows 10-year comparative data on its operations . . .

Louisville Gas & Electric Co has a photograph as you open the report which shows a shot up the Ohio River with the caption "Room for Growth" . . . Montana-Dakota Utilities Co uses small photographs to good advantage . . . Niagara Mohawk Power Corp gives a brief review of the Niagara story and other power projects, including St. Lawrence . . . Puget Sound Power & Light Co has a good water photograph as you open the book with the opening sentence saying "The source of low-cost power in this region is water" . . . Quebec Power Co has a very readable report, simple and eye catching. Charts, tables, and the area served map are excellent.

RATES

Montana-Dakota Utilities Co gets Wyoming PSC approval to increase electric rates in Sheridan by $86,358 a year as against $105,254 asked for by the company. PSC says company will earn a 6.25% return on its investment in the Sheridan Division. MDU's estimate of $889,439 as a proper depreciation reserve in the Sheridan Division was increased by the PSC to $950,000 as "being more nearly representing the amount Sheridan consumers have paid to the company's total depreciation reserve."

Seattle City Light puts in new rate to attract large electrochemical and steel plants. Plan provides a lower monthly minimum charge when the consumer avoids maximum use during peak hours—from 4:30 to 7:30 PM in winter months. P. C. Spowart, assistant superintendent of City Light, says the price the city pays Bonneville Power Administration for power is based on the city's peak purchase of the year. If peaks can be lowered, he said, the city will pay at a lower rate the year around.

An "all-out fight" to junk Ohio's methods of basing rates on "reproduction cost new, less depreciation" of utility properties is begun by the Ohio Municipal League. Legislation will soon be introduced which will grant utilities only a "fair return" on their actual investment.

Painesville, Ohio, is considering an estimated $98,270 a year rate increase to bring rates in line with those of the Cleveland Electric Illuminating Co, Superintendent O. E. Ficker told the City Council recently.

LABOR

Utah Power & Light Co and IBEW agree to a general 5% wage increase and elimination of the first step of the five year schedules.

Electric utilities are using booklets to attract engineering students. The latest is Pennsylvania Power & Light Co. It has just issued one entitled "Opportunities in Engineering with Pennsylvania Power & Light Co." For copy write, P. W. Siekman, assistant to vice president, operating, PP&L, Ninth and Hamilton St, Allentown, Pa.

ACQUISITIONS

An ordinance of intent has been passed by the Town of Utica, Miss., to sell its distribution system to Mississippi Power & Light Co. As EW was going to press, a franchise election was being held . . . Carolina Power & Light Co has asked North Carolina Public Service Commission approval to purchase the facilities of the Rocky River Power & Light Co for $36,297.32.

PUBLIC RELATIONS

After Consolidated Edison Co of New York had offered to buy the three New York City's power plants for $90 million, it inserted an ad titled "A Personal Letter to Employees of the Transit Authority, Power Division." It said that no employee will lose his job. The ad gave eight reasons why city power plant employees would be better off with Con Ed. For copy of the ad, write to William Brady, Con Ed, 4 Irving Place, New York 3, N. Y.

Up-and Up-and Up-Go POWER DEMANDS IN TEXAS

Neches Power Station, serving a fast-growing industrial region, is situated on the south bank of the Neches River, near Beaumont, Texas.

During 1956 the installation of an outdoor unit comprising a turbine generator with a capability of 111,000 kilowatts, a 700,000 pounds per hour boiler and associated water cooling tower was completed at the Neches Power Station of Gulf States Utilities Company. A second such unit is due for completion in 1958.

These are the seventh and eighth units at the Neches Station which first went into operation in 1926 with a single 20,000 kilowatt generator and two 1,530 horsepower boilers. The present capability of the station is 376,000 kilowatts and 3,000,000 pounds of steam per hour.

The initial installation and all subsequent additions were designed and built by Stone & Webster Engineering Corporation.

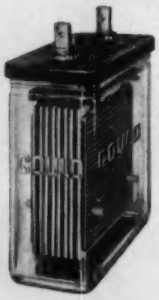
Write or call us for information as to how our experience may be of assistance to you.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY of STONE & WEBSTER, INC.

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Seattle Toronto

PLAY SAFE... buy the battery that gives you "extra runs" every year.



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The Aristocrat of
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Gould application engineers provide you with a continuing service that helps you keep batteries running longer. Try us and see.

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More Power to you from Gould

gould BATTERIES

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Always Use Gould-National Automobile & Truck Batteries

SALES ASSIGNMENTS

COMPANY STAFFS

Burndy Corp's Utility-Industrial Division has appointed Richard Harap chief field engineer of its expanded field engineering group, with James T. Gale as senior field engineer. Henry Shavel and Jerome S. Penzner are new field engineers.

General Electric Co has designated Charles H. Holland manager of industrial and transportation sales for the Pacific Southwest district of the Apparatus Sales Division . . . Robert J. Hall has been named a turbine specialist for GE's central district, which includes North Dakota, Minnesota, Wisconsin, and parts of Michigan, Indiana, Illinois, Iowa, South Dakota, and Montana . . . Construction Materials Division's Southwestern district has named James S. Hurlburt as manager to succeed the late Charles W. Maledon.

Graybar Electric Co, Inc, has advanced J. A. Reagen from office salesman to operating manager at Green Bay . . . New supervisors in the Texas Gulf Coast area are F. D. Bethel, major appliances manager, who will supervise sales for Corpus Christi, Beaumont, and Houston branch houses; and Jon L. Cochran, who will supervise sale of Graybar television, air-conditioners, and housewares for the same three cities.

Olin Mathieson Chemical Corp has appointed Ralph Biersach to head west coast sales for the Electrical Division. His headquarters will be in Los Angeles.

Pittsburgh Reflector Co has expanded the coverage of Howard E. Johnson of the Dallas sales office, southwest territory, to include the entire states of Texas and Oklahoma.

Pittsburgh Standard Conduit Co has designated J. S. Hamley as sales service manager. He is former purchasing agent.

Potter & Brumfield, Inc, a subsidiary of American Machine & Foundry Co, has appointed Lindsay L. Lenhart a sales engineer. He will be attached to P&B's Chicago office.

Westinghouse Electric Corp has assigned Joseph C. Belloni as Pacific Coast manager of distribution services and resident director of the new distribution center at Ogden, Utah. The center, first in a nationwide network planned by Westinghouse, will serve the 11 far western states, Hawaii, and Alaska.

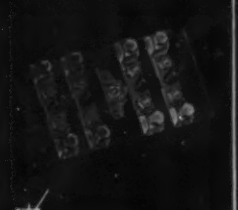
REPRESENTATIVES

Dow Corning Corp has appointed J. R. Christensen Agency of Salt Lake City, Utah, as a distributor to the electrical industry for silicones.

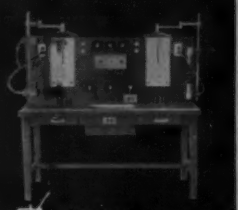
Memco Engineering & Manufacturing Co, Inc, has appointed Robert F. Leahy as representative for the Greater Philadelphia area and the DelMarVa peninsula.

Check with Superior on...

SWITCHES



BLOCKS

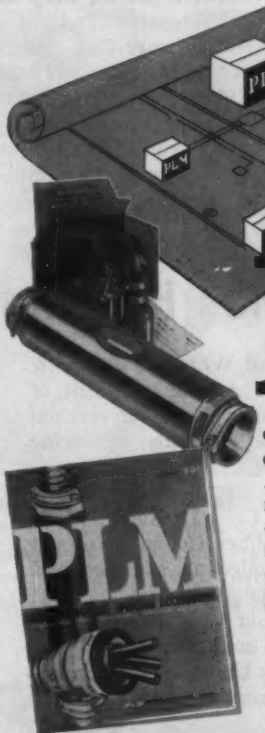


TABLES

SOCKET EQUIPMENT

ENCLOSURES of all sizes

SUPERIOR SWITCHBOARD & DEVICES CO.
CANTON, OHIO
A subsidiary of The Union Metal Manufacturing Company



simple way
to speed up planning . . . ordering . . . installing cable splices and terminations
UNIT PACKAGE KITS FROM
PLM

• Planning and ordering materials from many sources for cable splices and terminations is time-consuming . . . costly . . . often wasteful. PLM Unit Packages assure that correct materials, in correct amounts, for correctly designed splices or terminations, will be at hand where and when they are needed.

PLM Kits are available for armored cable, non-metallic sheathed cable and lead-covered cable, in ratings through 23 kv. Together with PLM armored cable terminating fittings for all types of standard and special applications, they provide a simple way to speed up planning, ordering, installing. Put the details up to PLM—send for copy of new PLM Catalog 301 today!

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WIRE AND CABLE FITTINGS AND ACCESSORIES

J. WILLIAM BENNETT

MARLOWE G. MOSES

RUSSELL D. PURRINGTON

WME Ups Bennett, Moses, Perry, Purrington

In a series of executive promotions, Western Massachusetts Electric Co recently elected J. William Bennett as vice president in charge of engineering; Marlowe G. Moses as chief engineer; Harold Perry as general purchasing agent; and Russell D. Purrington as superintendent of steam production in the Springfield area.

Bennett joined the company in 1930 as engineer in charge of underground distribution and transmission design, and later rose to assistant chief engineer. He has been chief engineer since 1944. During this period he was responsible for the design of the downtown underground network system in Springfield and the design and construction supervision of the new West Springfield steam plant.

Moses, who has served as assistant chief engineer since 1946, came to WME in 1945 as system planning engineer. Before that time he was with Northwestern Service Corp as an electrical engineer and with Northern States Power Co as planning engineer and later as assistant manager of that department. From 1942 to 1945 he was on special assignment as a research associate at Harvard University engaged in military research and manufacturing programs sponsored by the National Defense Research Committee.

As new general purchasing agent, Perry will succeed Ralph A. Benjamin, who is scheduled to retire in May. Benjamin will perform special services in purchasing and inventory control pending retirement.

In addition to his new post, Purrington will retain the position he has held since 1950 as superintendent of the West Springfield station. Purrington, a Worcester Polytechnic Institute graduate, has served in various capacities since joining the company in 1934.

Wisconsin P&L Names Herrmann to New Post

Newly elected vice president and treasurer of Wisconsin Power & Light Co is C. C. Herrmann, who has served as vice president of accounts and finances since 1953. His election as treasurer resulted from reorganization of the company's treasury activities following the recent death of Otis Gerke, former treasurer.

Herrmann began his utility career in 1924 as a member of the financial department of Middle West Utilities Co. He subsequently was employed by Central and South West Utilities Co and returned to Middle West in 1932 as a staff member in budgeting, statistics, and accounting. Later he was named financial analyst at Middle West. From 1942 to 1953, when he came to Wisconsin P&L, he was associated with Southwestern Gas & Electric Co as controller.

In another company promotion, James R. Underkofler was appointed assistant treasurer and administrative assistant. He formerly served as administrative assistant.

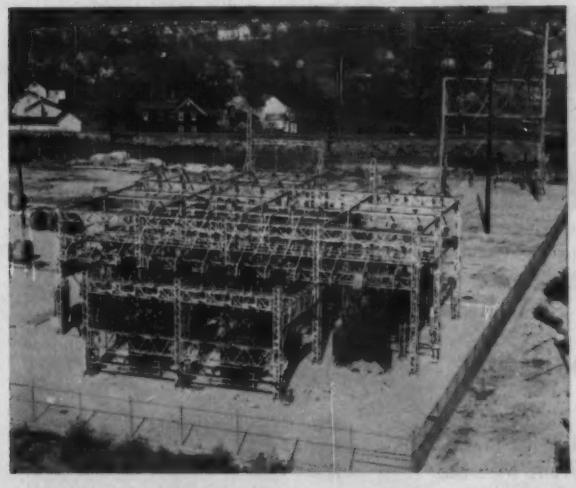
C. C. HERRMANN

How Bell System private line communications serve the power industry

Bell System private line channels help streamline Ohio Edison operations 4 ways

1. **Continuous metering** and load control of Ohio Edison's interconnected electric system is centered at the Company's central dispatching office in Massillon. Extensive use is made of Bell System circuits in this system.

2. **Private line telephones** form an important link between power plants (like the Niles plant, above) and the Massillon dispatching center, permitting close control of operations. The Edison Company serves more than 550,000 customers.



3. **Bell System circuits** for remote metering and control give the Akron division dispatcher an up-to-the-minute picture of conditions at substations in his area. Similar circuits also provide supervisory control over substations in certain other areas served by the Company.

4. **Audible indicating** enables Ohio Edison dispatchers to pick up the telephone, dial certain unattended substations and learn from a tone signal the existence of trouble at that particular substation. This system provides an additional safeguard for service continuity.

Bell System communications can work for you just as they do for Ohio Edison. Call your Bell Telephone Company business office. A representative will be pleased to study your communications needs.

BELL TELEPHONE SYSTEM

PRIVATE LINE TELEPHONE • PRIVATE LINE TELETYPEWRITER CHANNELS FOR: DATA TRANSMISSION • REMOTE METERING AND CONTROL • TELEPHOTOGRAPH • CLOSED CIRCUIT TV

Hills Is Advanced to Purchasing Agent

GEORGE A. HILLS

Central Maine Power Co has elevated George A. Hills from assistant to the purchasing agent to purchasing agent to succeed Wallace A. Price. Price, who held that post since 1934, retired March 1 after about 37 years service.

Hills has been with Central Maine since 1945, when he joined the company's purchasing department. He was advanced to the post of expeditor two years later. In 1952 he was named to his most recent position.

Price served in the firm's securities, treasury, and accounting departments, and later rose to district superintendent and a division manager.

Stewart to Head Area Development

Carolina Power & Light Co has appointed Daniel E. Stewart as manager of the area development department. He succeeds S. Paul Vecker, vice president in charge of the department, who retired recently after 22 years with CP&L.

Stewart has spent the past 13 years in development work, including agricultural, industrial, and community promotion. An electrical engineering graduate of North Carolina State College, Stewart started with CP&L in 1925 as student manager. He served in industrial power sales from 1927 to 1937 and in 1938 became Western Division superintendent. He was assistant division manager from 1939 to 1943.

DANIEL E. STEWART

Buckley Is Elected Standard President

CHESTER F. BUCKLEY

Chester F. Buckley has been elected president and general manager of Standard Transformer Co concurrent with the recent purchase of Standard by American Gas & Machine Co. He succeeds retiring president Worthington F. Parker.

Until this appointment, Buckley was a member of the New England consulting engineering firm of Chester F. Buckley & Associates.

A graduate of Massachusetts Institute of Technology, Buckley was at one time associated with Brooklyn Edison Co, Massachusetts Electric Light Co, and National Silver Co, where he served as works manager.

PERSONAL BRIEFS

Robert P. Welsh, assistant secretary and assistant treasurer of Gulf Power Co, has been elected secretary and treasurer.

G. O. Lew Pohl, on leave from Tacoma (Wash.) City Light, has been named acting manager of Lakeview Power & Light Co, which buys power from TCL. He succeeds **William J. Jones** who has resigned.

A. C. Scott has been named meter superintendent of Georgia Power Co's Atlanta Division to replace **R. B. Patrick** who has retired.

Harry Ferguson, Pennsylvania Power & Light Co's operating vice president, and **John A. Noble,** president of Cleland Simpson Co, have been named directors of PP&L.

The sales departments of Jersey Central Power & Light Co and New Jersey Power & Light Co have appointed **William Westenhoefer** application engineer and **William S. Sally** as assistant manager of sales promotion and sales advertising.

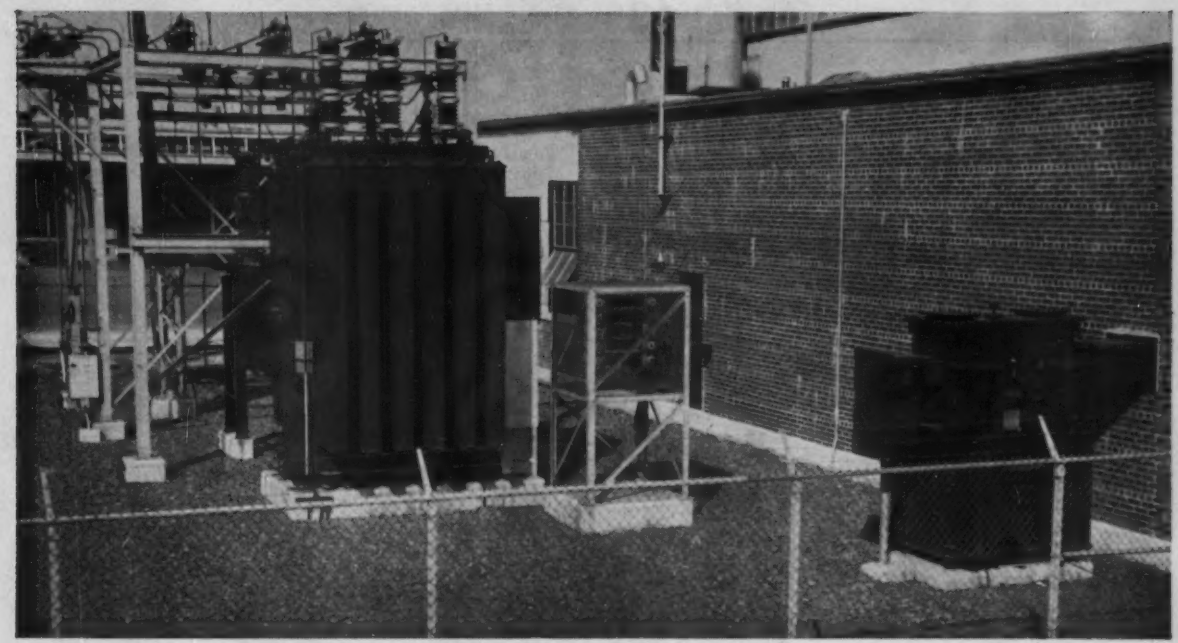
In Iowa, **Ray H. Thompson** was elected in the recent general elections to the State Commerce Commission for a four year term.

Roderic D. Smith and **Roland L. Nims** have been appointed to direct sales promotional and engineering activities of major appliance, electric housewares, electric fan and commercial cooking equipment sections of the National Electrical Manufacturers Association.

Walt L. Treadwell has been named chief engineer of Pacific Coast Engineering Co . . . Newly named general counsel of The Anaconda Co is **C. Jay Parkinson,** who continues as vice president and director of Anaconda Aluminum Co.

Consolidated Coppermines Corp has announced the appointment of two new vice presidents. They are **Albert S. Redway,** president of Rockbestos Products Corp, a subsidiary; and **W. W. Sieg,** president of Titan Metal Manufacturing Co, also a subsidiary.

WAGNER TRANSFORMERS...THE CHOICE OF LEADERS IN INDUSTRY



Wagner Power and Unit Substation Transformer installation at Air Reduction Sales Company—Riverton, N. J.

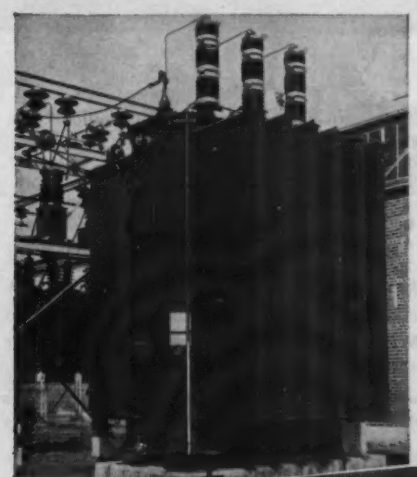
Taking raw materials from the air

The Air Reduction Sales Company manufactures liquid products direct from the atmosphere—products like oxygen, nitrogen, argon, and neon. In some cases, the liquids are then converted into gases for industrial and medical use.

Such scientific sleight-of-hand in transforming air into product is made possible on a mass-production basis only through the use of electricity . . . the source of power for all modern production.

Wherever electric power is used, Wagner Transformers efficiently and dependably handle their never-ending job of supplying proper voltages for every purpose. At Air Reduction's Riverton, New Jersey plant, this power is supplied through Wagner Transformers.

Let a skilled Wagner engineer discuss your transformer needs with you. Call the nearest of our 32 branch offices, or write us direct.



This 7500 kva Wagner Power Transformer supplies power for Air Reduction's Riverton, N. J. plant.

The 1000 kva Wagner Unit Substation Transformer steps down to 480 volts for distribution in the plant.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

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ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

MEETINGS CALENDAR

MARCH

Canadian Electrical Association — Western Zone Meetings, Hotel Vancouver, Vancouver, B C., Mar. 18-20.

Institute of Radio Engineers—Annual National Convention and Radio Engineering Show, Waldorf-Astoria Hotel and New York Coliseum, Mar. 18-21.

American Society of Mechanical Engineers — Gas Turbine Conference, Sheraton-Cadillac Hotel, Detroit, Mich., Mar. 18-21; Engineering Management Conference, sponsored jointly with the American Institute of Electrical Engineers, Penn Sheraton Hotel, Pittsburgh, Pa., Mar. 27-28.

Edison Electric Institute—Industrial Relations Committee, EEI Headquarters, New York City, Mar. 21.

Electric Meter Institute—Eighth Annual Session, University of Denver, Denver, Colo., Mar. 25-29.

American Power Congress—19th Annual American Power Conference, Hotel Sherman, Chicago, Ill., Mar. 27-29.

Oklahoma Utilities Association — Annual Convention, Hotel Tulsa, Tulsa, Oklahoma, Mar. 28-29.

Illuminating Engineering Society—Pacific Northwest Regional Conference, Empress Hotel, Victoria, B. C., Canada, Mar. 28-30.

APRIL

Edison Electric Institute—Industrial Power and Heating Committee, Edgewater Beach Hotel, Chicago, Ill., April 1; Sales Conference, Edgewater Beach Hotel, Chicago, April 1-4; Accounting Division Advisory and Executive Committee, Madison Suite, Sheraton Park Hotel, Wash., D. C., April 8; National Accounting Conference of Electric & Gas Utility Accountants, held jointly with AGA, Washington, D. C., April 8-10; Industrial Relations Committee, jointly with Personnel Sections of Indiana Electric Assn. and Ohio Electric Utility Institute, and Personnel Practices Committee of Pennsylvania Electric Assn., Netherland Plaza Hotel, Cincinnati, Ohio, April 18-19; Meter and Service Committee, Soreno Hotel, St. Petersburg, Fla., April 24-26; Purchasing and Stores Committee Executive Committee and 10th Annual Meeting, Penn Sheraton Hotel, Pittsburgh, Pa., April 28-May 1; Insurance Committee, Williamsburg Inn, Williamsburg, Va., Apr. 29-30; Accident Prevention Committee, Algiers Hotel, Miami Beach, Fla., April 29-May 1.

Southeastern Electric Exchange — 24th Annual Conference, Boca-Raton Hotel and Club, Boca Raton, Fla., April 1-3.

National Industrial Conference Board — 8th Atomic Energy Courses for Management, Rye, N. Y., April 1-6.

Indiana Electric Association—17th Annual Young Men's Utility Conference, Terre Haute House, Terre Haute, Ind., April 3-4.

American Institute of Electrical Engineers—Southern District Meeting, Heidelberg Hotel, Jackson, Miss., April 3-5; Great Lakes District Meeting, Hotel Fort Des Moines, Des Moines, Iowa, April 15-17; Third Biennial Conference on Electric Heating, sponsored jointly by AIEE and the Toledo section of AIEE, Commodore Perry Hotel, Toledo, Ohio, April 23-24.

Missouri Valley Electric Association—Engineering Conference, Hotel President & Municipal Auditorium, Kansas City, Mo., April 3-5.

Northwest Public Power Association — Annual Membership Meeting, Benjamin Franklin Hotel, Seattle, Wash., April 3-5; Engineering and Operations Section, Tacoma Utility Center and Winthrop Hotel, Tacoma, Wash., April 23-24.

American Society of Mechanical Engineers—Spring Meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala., April 8-10.

Northeast Missouri Electric Power Cooperative—Eighth Annual REA Electric Generating Plant Operation and Maintenance Conference, Phillips Hotel, Kansas City, Mo., April 8-11.

National Electrical Industries Show—Fourth National Electrical Industries Show, 71st Regiment Armory, Park Ave. and 34th St., New York City, April 8-11.

Public Utilities Association of the Virginias—Rural Committee, Jackson's Mill, W. Va., April 9; Executive Committee, Richmond, Va., April 12.

Institute of Radio Engineers—First Annual Conference on Electronics in Industry, Illinois Institute of Technology, Chicago, Ill., April 9-10.

American Welding Society—Fifth Welding Show, Convention Hall, Philadelphia, Pa., April 9-11.

Electrical Engineers (ASEE) Exhibition, Ltd—Sixth Electrical Engineers Exhibition, Earls Court, London, England, April 9-13.

Pennsylvania Electrical Association—Meter Committee, Garden City, Long Island, New York, April 11-12.

Maryland Utilities Association—Annual Spring Business Conference, Lord Baltimore Hotel, April 12.

Agricultural and Mechanical College of Texas—Tenth Annual Conference for Protective Relay Engineers, A&M College of Texas, College Station, Tex., April 15-17.

Rocky Mountain Electrical League—Spring Conference, Shirley-Savoy Hotel, Denver, Colo., April 21-24.

• **National Industrial Research Conference** — Sponsored by Armour Research Foundation of Illinois Institute of Technology, Conrad Hilton Hotel, Chicago, Ill., April 24-25.

Association of Edison Illuminating Companies and Edison Electric Institute—Meter and Service Committee, Soreno Hotel, St. Petersburg, Fla., April 24-26.

Northwest Electric Light & Power Association—Engineering and Operating Section, Sun Valley, Idaho, April 24-26.

• **American Power Dispatchers Association, Inc**—National Spring Meeting, Los Angeles, Calif., April 26-27.

Institute of Radio Engineers—Eleventh Annual Technical Conference on Television, Cincinnati Engineering Society Bldg., Cincinnati, Ohio, April 26-27.

MAY

Edison Electric Institute—Transmission and Distribution Committee, Muehlebach Hotel, Kansas City, Mo., May 2-3; Prime Movers Committee, Tides Hotel, St. Petersburg, Fla., May 6-8; Industrial Relations Committee, EEI Headquarters, New York City, May 16; Electrical System and Equipment Committee, Statler Hotel, Buffalo, N. Y., May 20-21; Accounting Division Time and Place Committee jointly with AGA, AGA Headquarters, New York City, May 22; Financing and Investor Relations Committee, Edgewater Beach Hotel, Chicago, Ill., May 31-June 1.

Southeastern Electric Exchange — Engineering & Operations Sections, Fontainebleau Hotel, Miami Beach, May 2-3.

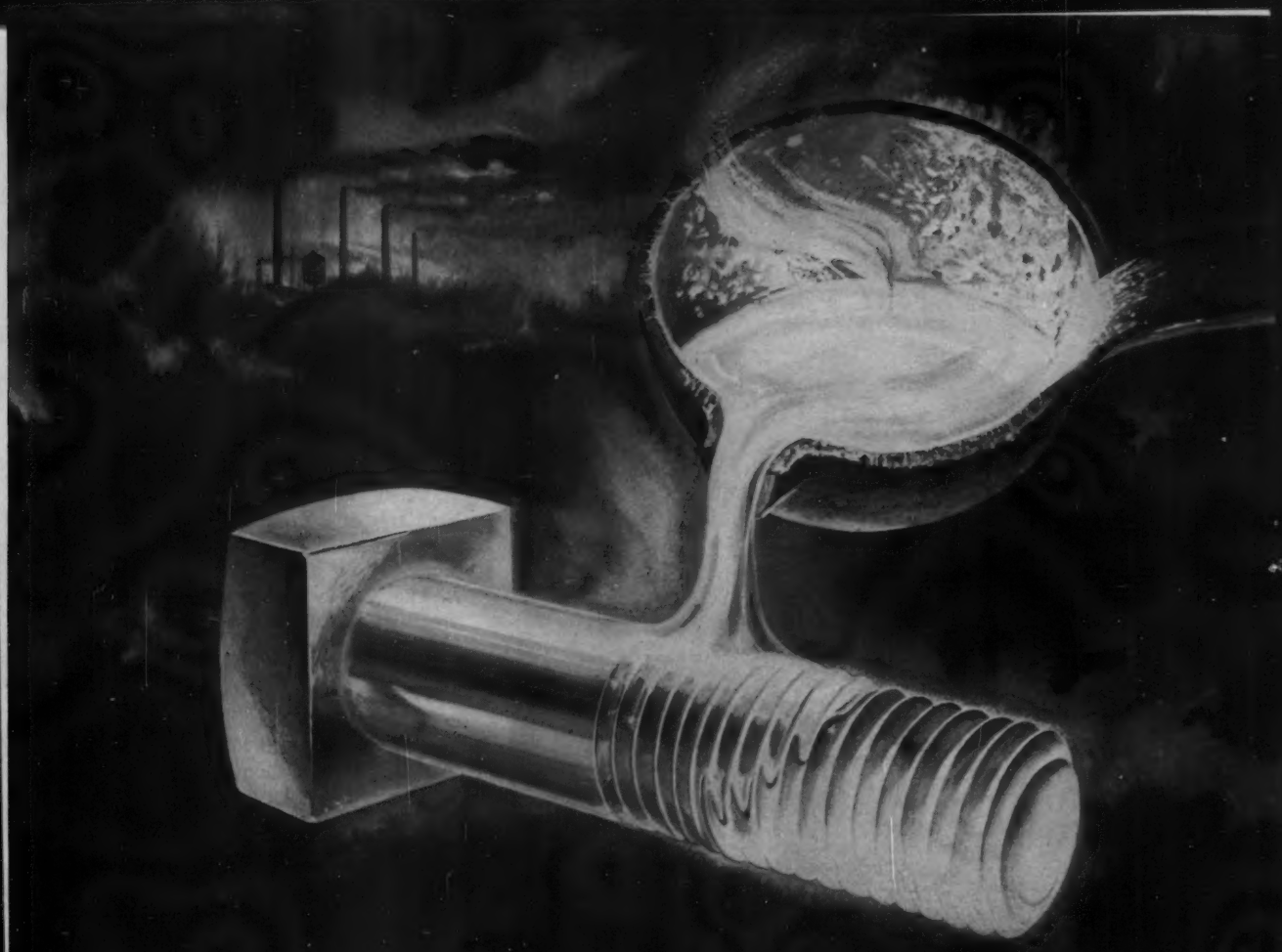
• **Air Conditioning and Refrigeration Institute**—Annual Meeting, The Homestead, Hot Springs, Va., May 5-8.

• **Pennsylvania Electric Association**—Eighth Annual Customer Relations Conference, Hotel Hershey, Pa., May 8; Electrical Equipment Committee, Hotel Roosevelt, Pittsburgh, Pa., May 9-10.

• Additions this week.

Edison Electric Institute

Annual Convention will be held in the Palmer House, Chicago, Ill., on June 3-5.



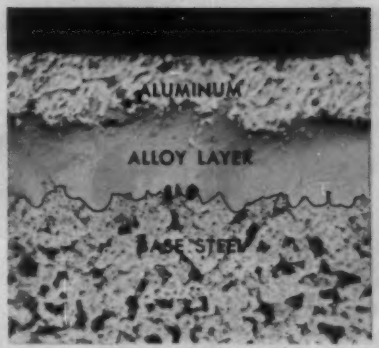
The illustration is symbolic — in practice, Bethlehem fasteners are dipped in molten aluminum, then centrifuged, producing a coating that is uniformly smooth over the entire surface.

Bethalume Coating for Fasteners is Superior in Corrosive Atmospheres

Looking for longer service life from steel fasteners exposed to corrosive conditions? Use fasteners which are protected by Bethlehem's Bethalume coating — the hot-dip aluminum coating which, in equal thicknesses, outlasts zinc in most corrosive atmospheres.

With Bethlehem's new coating facilities, fasteners of virtually all types and sizes can be coated with a smooth layer of corrosion-resistant aluminum. Excess coating is removed quickly while in the molten state, leaving the coated threads clean and sharp.

If you would like to know more about the Bethalume coating for fasteners, and the long service life it makes possible in atmospheric and heat corrosion, just get in touch with the nearest Bethlehem office.



Section through Bethalume coating, showing aluminum overlay and iron-aluminum alloy layer.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

CORROSION-RESISTANT
FASTENINGS
with High Safety Factor

Strict adherence to specifications, interchangeability, dependability, and long service life—these are inherent characteristics of Harper Corrosion-Resistant Fastenings—the accepted standard in the electrical field.

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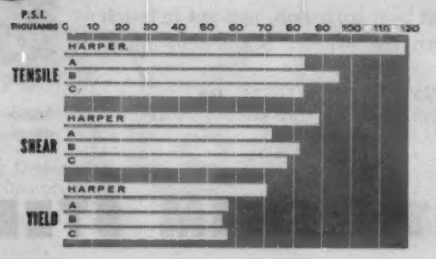
*By R. W. Hunt Laboratories



Lakeside Station

(Continued from page 75)

porary building wall, can be increased in size to accommodate controls for four units when these are installed.

Lighting of the main control room is fluorescent over a solid luminous ceiling of corrugated acrylic plastic panels. This ceiling was preferred to an egg-crate type to minimize glare from the instrument glasses, particularly those on the steep portion of control desks.

The main control room is air conditioned. The space behind the vertical boards is supplied with filtered but not cooled air under pressure to minimize the accumulation of dust.

The 138-kv switchyard includes five, two-circuit bays to accommodate two generators, four lines, the reserve auxiliary transformer, and the transfer breaker. There are two main buses with a transfer bus between them at a higher elevation. All are of 5-in. aluminum tubing, and rigid cross buses below carry connections to the main bus. Tubing joints are welded. Strain buses between towers overhead carry connections to the transfer bus. These strain buses are of stranded aluminum without steel reinforcement to minimize corrosion.

The switchyard design was influenced in important respects by the potential dust problem presented by the neighboring cement plant. All equipment bushings are rated 138 kv, extra creep. All bus and switch insulators are rated 161 kv. Extra discs were included in the strain strings. The provision of two main buses and an elevated transfer bus makes it possible to clean almost every insulator in the yard with the station at full output.

The 138-kv breakers are rated 5,000,000 kva interrupting capacity, but are built for later conversion to 10,000,000 kva. This provision was made because the duty will be approximately 7,000,000 kva when the station is developed to its ultimate capacity of six units. The initial installation includes a generator breaker, three line breakers, and a transfer breaker which can substitute for any of the others.

The reserve auxiliary transformer is connected to the transfer bus or to one main bus with disconnects, with space for future breaker.

Trinity Project . . .

partnership plan attacked at California Municipal Utilities Association meeting

Joint development of the Trinity project in California came under fire at the 25th annual conference of the California Municipal Utilities Association, Palo Alto, Feb. 19-22.

Alex Radin, general manager, American Public Power Association, took Interior Secretary Seaton to task for his recommendation that Pacific Gas & Electric Co be allowed to develop the hydroelectric facilities of the multi-purpose Trinity project (EW, Feb. 25, p 43). Seaton's proposals "are so clearly contrary to long-established policies, so opposed to the public interest, so detrimental to electric power consumers, and so violative of existing laws, that it is astounding they should be given serious consideration," said Radin.

The question of taxation of the interest from municipal bonds is a matter of continuing concern, Radin observed. There are repeated efforts to remove this tax exemption. Recently, Congressman Mills (D-Ark.) stated that Congress may have to consider raising taxes on various types of income, including interest from municipal bonds.

Urges Naval Development

Samuel B. Morris, consulting engineer, Los Angeles Dept of Water & Power, declared the government should provide more impetus toward development of nuclear power plants for naval use. This development would contribute to the advancement of stationary power plants. Morris, who is also chairman of APPA's Atomic Energy Committee, said that for maximum development of power reactors, the question of a guaranteed price for repurchase of spent fuel by the government must be answered. He felt that sufficient insurance against "catastrophic" plant disasters is necessary.

New officers elected during the conference were: president, Paul Beerman, Water Dept, San Diego, and vice president, R. J. Brusatori, Marin Municipal Water Dist, San Rafael.

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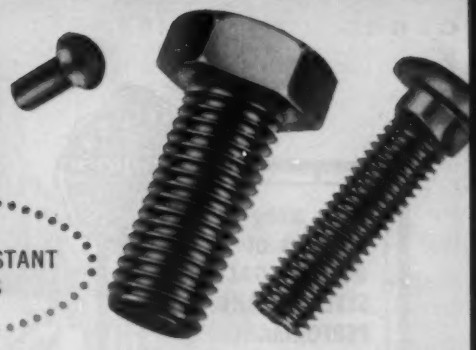

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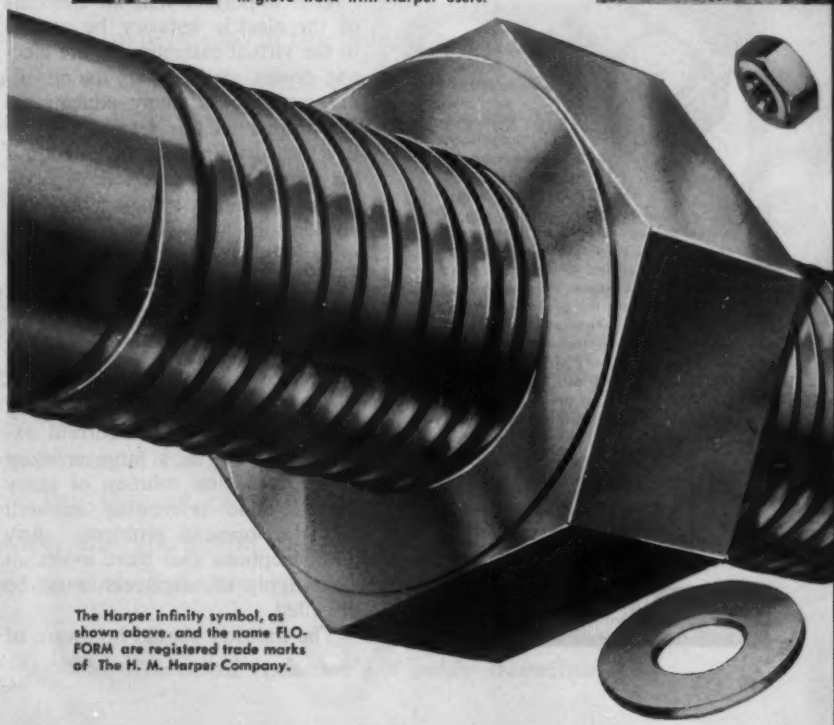

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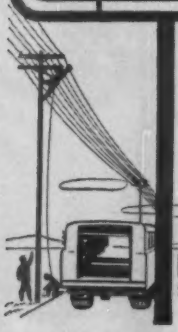

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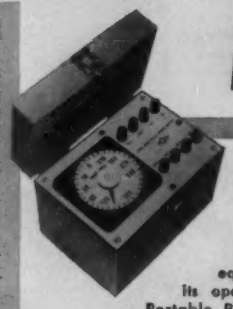

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READERS FORUM

California Revitalizes Power Curriculum

To the Editor:

The article "Power Teaching Can Be Revitalized" (EW, Jan 7, p 54-56) suggested these comments pertinent to the situation. Undergraduate instruction in electric power is being reexamined and streamlined at the University of California. If enrollment figures for the present academic year give an insight to the future, it would appear the descending spiral of electric power students reached a low last year. Although the numerical increase this year is small, the group petitioned for power courses scheduled "not to be offered" and stemmed the tide of vanishing instruction in this field.

The decision to continue instruction, in spite of decreasing student enrollments, is based to a very considerable extent upon encouragement from major utilities of the state and engineering design and construction firms. It is conceded unanimously that California, like the rest of the nation, must have an annual increment of graduates trained in electric power if the industry is to continue to double every ten years.

It is important that all elements of the electric industry be alerted to the virtual extinction of the electric power student and the resulting response of many educational institutions to this trend. Corrective measures must be taken soon if the trend is to be reversed.

During National Engineers Week, and through high school counselors, much can be done to tell parents and their high school sons of the great need for young engineers and of the many worthwhile opportunities in the electric power field. The impetus must come from the electric industry. It can and should publicize the fact that current expansion is due in a large measure to the successful solution of many intricate and interesting research and development problems. Any misconceptions that there exists an over-supply of engineers must be dispelled.

The industry should be aware of the very substantial financial aid available in the form of scholarships and fellowships in closely competitive fields and the dearth of these incentives in the entire area of electric power. Possibly scholarships sponsored by individual enterprises and also by national and regional industry groups might do much to replenish the tide of students in electric power.

The ability of any curriculum to attract both faculty and students depends to a large extent upon the stimulus of available research problems. Such research problems must be fed into educational institutions by the industry through close liaison between representatives of both groups. The primary purpose of this arrangement is not to solve problems for industry, although this might be an important by-product, but to eliminate the widespread lethargy associated with the lack of research in electric power in educational institutions.

Charles F. Dalziel
Prof of Electrical Engineering
University of California
Berkeley, Calif.

• EW will be glad to report changes in power curricula made at other universities or any upswing in engineering students.

CEMIG Was Buyer

To the Editor:

We were very much interested to see in your Feb. 4 issue an announcement that the S. Morgan Smith Co is manufacturing the hydraulic turbines for the Itutinga and Camargos Hydroelectric Plants in Brazil.

We would like to point out that this equipment was purchased directly by CEMIG rather than by Ebasco International Corp as was inadvertently stated.

H. A. Mayo, Jr,
Sales Engineer
S. Morgan Smith Co
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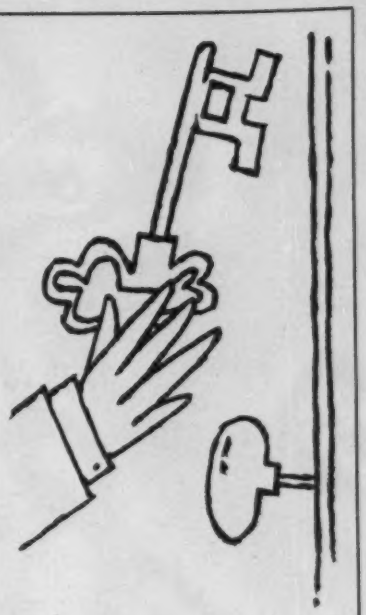

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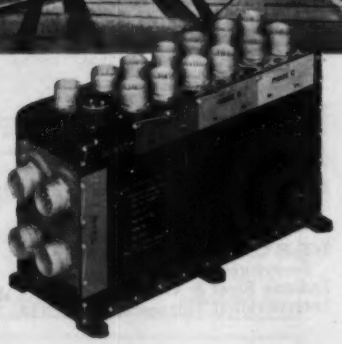
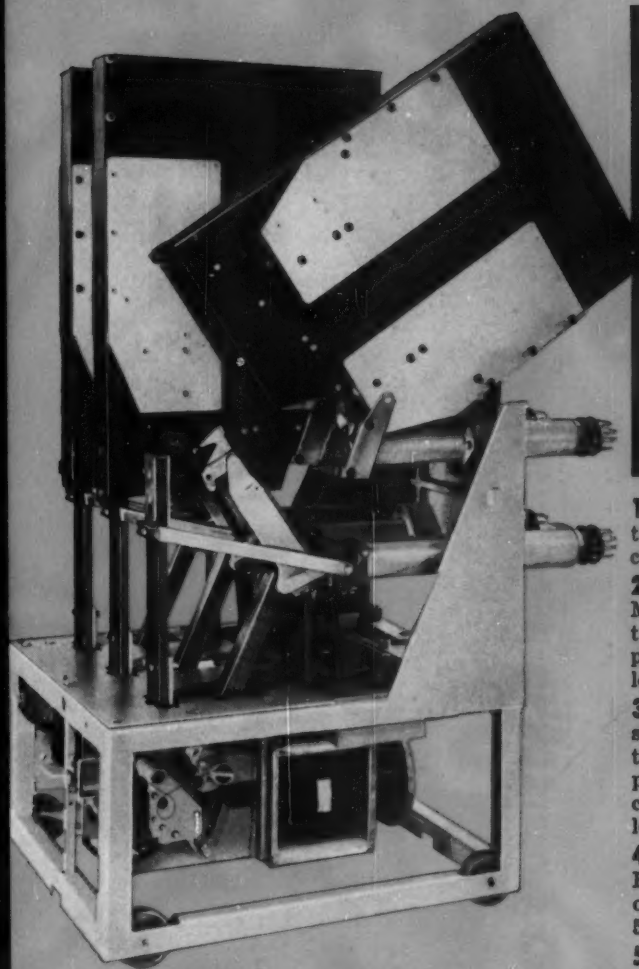


Cole 60 KW
400 Cycle, 3 Phase
Electrical Substation

Qualified military personnel and missile manufacturers only: Write for complete description and technical data to Cole Electric Company, 8439 Steller Drive, Culver City, Calif.

ADVANCED 500 MVA CIRCUIT BREAKER



Highlights Federal Pacific Switchgear Design

1. HINGED ARC CHUTE—easily tilted for quick, positive inspection of contacts.

2. SIMPLIFIED RACKING-IN MECHANISM—Simple, sturdy, positive...this device has only two moving parts...provides a positive mechanical lock in test position.

3. SINGLE, LARGE SIZE PUFFER—serves all three contacts. Designed into the mechanism structure, the new puffer gives the breaker the desirable characteristic of fast interruption on low currents.

4. EXTREMELY FAST ARC INTERRUPTION—accomplished by principle of arc elongation and cooling, occurs in 5 cycles or less.

5. NEW BAFFLE CONSTRUCTION—constructed of a specially produced material designed to withstand drastic heat-shock without cracking or otherwise disintegrating.

In Standard Ratings from 75 MVA (5-kv Class) To 500 MVA (15-kv Class), 600, 1200 and 2000 Amperes

The 500-mva, 15-kv type DST air circuit breaker completes the Federal Pacific line of metal clad switchgear with 5-cycle magnetic breakers designed for ease of maintenance and maximum ruggedness.

Incorporating all of the most advanced features in an integrated design, the improved DST breaker has been thoroughly tested at the world-famous KEMA laboratories to withstand the rigorous requirements for this class of equipment. In production at Federal Pacific's Scranton plant, the DST breaker offers maximum safety, efficient circuit protection, low installed cost.

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KUHLMAN "Salesman of the Week"

If you can identify this Kuhlman Electric Co. representative, and are the first one to notify Dept. SA-1, Kuhlman Electric Co., Bay City, Mich., you will receive a valuable gift certificate. Watch for the next Kuhlman "Salesman of the Week."

"Porcelain enamel will end your corrosion problems . . .

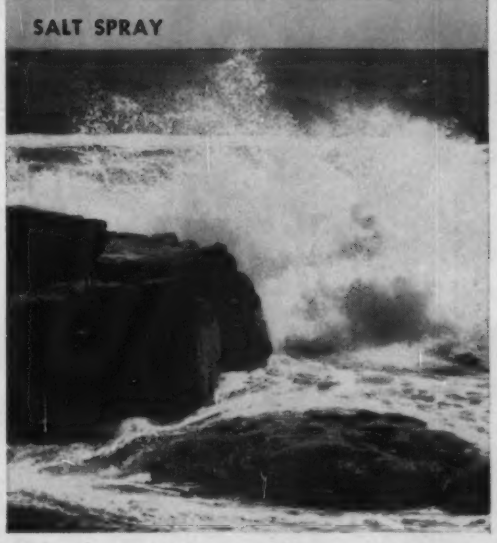
"Many of my customers have proved there is no need for expensive transformer repainting every few years. They changed to Kuhlman porcelain enamel transformers and are licking the problems of industrial fumes or coastal salt spray corrosion.

"Other transformer finishes, with special compounds for increasing protection, only coat the tank surface. In time, severe atmospheric conditions break down the cohesive film of these paints—they begin to flake and corrosion sets in. Now this doesn't happen to porcelain because porcelain frit is *permanently fused* to the tank metal at 1500°F.

"Most engineers agree that you can't beat porcelain for durability. It makes good sense to end your corrosion problems once and for all . . . install Kuhlman porcelain enamel transformers.

"Here's something else—Kuhlman porcelain transformers are equipped with non-corrosive hardware, too..."

1. Electrical bronze solderless connector.
2. Increased creep-distance to prevent salt deposit flash-over.
3. Stainless steel bushing clamps.
4. Bronze cover hold down nuts and pressure bar.
5. Bronze hand hole cover nuts.



Whether your corrosion problem is heavy industrial fume or severe salt spray, call in your competent Kuhlman representative for constructive advice.

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